CALFED
BAY-DELTA
PROGRAM

DRAFT

CALFED BAY-DELTA PROGRAM STORAGE AND CONVEYANCE COMPONENT INVENTORIES

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Preliminary Working Draft
CALFED Bay-Delta Program
Storage and Conveyance Component Inventories

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I. INTRODUCTION

The objective of this technical memorandum is to identify potential storage and conveyance opportunities which can be considered in the formulation of storage and conveyance alternatives during Phase II of the CALFED Bay-Delta Program (CALFED or Program).

This technical memorandum provides an inventory of storage and conveyance components that may have the potential to contribute to the CALFED objective of improving water management for beneficial uses of the Bay-Delta system. This inventory is comprised of a wide range of storage and conveyance opportunities potentially available as components for a CALFED solution strategy. Individual component inventories have been developed for surface storage, groundwater storage, and conveyance opportunities based on information derived from earlier or current investigations over the past several decades.

Presented within this memorandum are attribute tables for surface storage, groundwater storage, and conveyance components which identify the major characteristics of the components. Appendices A through C provide greater detail on the individual components included in the inventories for surface storage components, groundwater storage components, and conveyance components, respectively.

II. STORAGE AND CONVEYANCE COMPONENT INVENTORIES

One of the first objectives of the Storage and Conveyance Component Refinement Process has been the development of inventories of storage and conveyance opportunities. These inventories

of surface storage, groundwater storage, and conveyance components will later be screened in accordance with the requirements of the Clean Water Act, Section 404(b)(1). The component screening process will lead to a refined list of components which can be studied in further detail and which can also be bundled into discrete alternatives in later phases of the Program.

The opportunities identified in this effort are in addition to existing storage or conveyance facilities or projects; however, projects which would expand the physical capacities of existing facilities are included in the inventories. In the operations and facilities modeling and analysis task of the Storage and Conveyance Component Refinement Process, opportunities to reoperate existing facilities with and without developing new storage or conveyance facilities will be investigated.

In developing the storage and conveyance component inventories, numerous studies and ongoing investigations were reviewed to ensure that the most appropriate components were included. In particular, current efforts by the Department of Water Resources (DWR) for the Bulletin 160-98 Program (the California Water Plan Update) and the Los Banos Grandes Program were reviewed and incorporated. To aid in the initial selection of individual components, first-level selection criteria were developed. These criteria are (1) a storage facility must have a minimum new capacity of 100 thousand acre-feet (TAF), (2) a conveyance facility must have a minimum new capacity of 500 cubic feet per second (cfs), (3) the component must not, if implemented, conflict with existing laws, such as projects which would be located on federally designated Wild and Scenic Rivers or within Wilderness Areas, and (4) the component must have the potential to significantly contribute to the Program's objective of improving water supply reliability in the Bay-Delta system. The fourth selection criteria is subjective; however, only those components which are without question incompatible with the objectives of the Program were excluded from consideration. A component's potential ability to meet the objective of improving water supply reliability was evaluated using the following two criteria:

- Increase water supply opportunities in locations that could potentially benefit the Bay-Delta system.

- Improve operational flexibility of the State's water resources system.

The qualitative assessment of each component's ability to meet the above criteria is described in greater detail in the accompanying appendices. The attribute matrices also provide information on specific characteristics relevant to the type of component being considered as well as a list of references used to compile the information presented in the matrix.

The inventories for surface storage components, groundwater storage components, and conveyance components are described in the following sections. The inclusion of any component in the following inventories does not indicate an endorsement of that component by CALFED. The component inventories are a compilation of surface storage, groundwater storage, and conveyance opportunities that have been identified from previous studies and are intended to form a database of projects which will be considered for inclusion in alternative CALFED solution strategies.

SURFACE STORAGE COMPONENTS

The inventory of surface storage facilities includes 51 individual components. Table 1 lists each of the surface storage components along with the component's location, type, capacity, and a brief description. Figure 1 shows the general location of all surface storage components included in the inventory.

The surface storage components listed in Table 1 are separated according to five regions. The regions are (1) the west side of the Sacramento Valley, (2) the east side of the Sacramento Valley, (3) in-Delta, (4) South-of-Delta aqueduct storage (California Aqueduct and Delta-Mendota Canal), and (5) the San Joaquin Valley.

The surface storage components have been classified as either on-stream, off-stream, or combined storage, depending on the proportion of potential reservoir yield that is developed by local inflow or imported from other sources.

Appendix A contains attribute matrices for each of the surface storage components listed in Table 1. The attribute matrices contain all of the information included in Table 1, along with additional information available on the component's description, operation, capacities, estimated costs, and environmental impacts and other issues. The attribute matrices also contain a listing of references used to compile the information presented.

West Side of the Sacramento Valley

Surface storage components located on the west side of the Sacramento Valley are those components which are north of the Delta and west of the Sacramento River and include the Shasta Lake enlargement component (Figure 1). A total of 13 surface storage facilities have been identified in this region. Four of the components are new off-stream storage facilities located on the east side of the Coastal Range. Perhaps the most recognized of the off-stream storage facilities are the Sites and Colusa Projects, which could serve as storage facilities for surplus flows of the Sacramento River. Six new on-stream storage facilities have been identified in this region in the Cottonwood Creek basin and on other tributaries of the Sacramento River. Two of the storage components, the Clair Engle Lake and Lake Berryessa enlargements, are combined on-stream/off-stream storage facilities. The enlargement of Clair Engle Lake, which presently serves as an on-stream facility, could also serve as off-stream storage for excess Shasta Lake storage. An enlarged Lake Berryessa, which presently serves as an on-stream facility, could store surplus flows from the Sacramento River when combined with the appropriate conveyance facilities. The final surface storage component is the enlargement of Shasta Lake as an on-stream storage facility for Sacramento River flows.

East Side of the Sacramento Valley

Surface storage components in the region defined as the east side of the Sacramento Valley are located on or north of the American River and east of the Sacramento River, including tributaries to Shasta Lake (Figure 1). Fifteen storage facilities have been identified in this region. The majority of these components (11) are new on-stream storage facilities located primarily in the drainages of the Sierra Nevada mountain range.

Four new off-stream facilities have also been identified in this region. These off-stream storage facilities would divert and store flows of the Sacramento, Yuba, Cosumnes, or American Rivers. A single enlarged existing on-stream reservoir was identified at Folsom Reservoir.

In-Delta

Two surface storage components have been identified in the in-Delta region, located within the boundaries of the "legal Delta" (Figure 1). Both of these facilities are new off-stream storage facilities which would rely on converting Delta islands into island storage facilities. These island storage facilities would divert surplus flows from Delta channels for seasonal storage. Stored water would be released back to Delta channels for either environmental uses in the Delta, water supply needs of in-Delta diverters, or conveyance directly to CVP and SWP Delta diversion facilities.

South-of-Delta Aqueduct Storage

The region defined as south-of-Delta aqueduct storage refers to surface storage facilities which would be located close to the California Aqueduct or the Delta-Mendota Canal and which would serve as off-stream storage facilities for surplus flows diverted from the Delta (Figure 1). A total of 11 aqueduct storage facilities have been identified (Table 1). Water stored in an off-aqueduct

facility could provide increased water supply reliability as well as environmental benefits during periods when it is desirable or necessary to curtail Delta diversions.

San Joaquin Valley

The San Joaquin Valley region includes those surface storage facilities which are located on the San Joaquin River or one of its tributaries (Figure 1). A total of ten surface storage facilities have been identified in this region (Table 1). Eight of the components would serve as off-stream storage facilities for surplus flows from the Mokelumne, Calaveras, Stanislaus, Tuolumne, or Merced Rivers. Two of the components are enlargements of existing on-stream reservoirs at Millerton Lake and Pardee Reservoir.

GROUNDWATER STORAGE COMPONENTS

Groundwater storage components include conjunctive use and groundwater banking programs in the Sacramento and San Joaquin Valleys and in the Mojave Basin. A total of 17 groundwater storage components have been identified from a review of existing reports and investigations. The inventory of groundwater components provided in Table 2 includes the location of the component, the type of operation (conjunctive use or groundwater banking), estimated storage capacities, potential infrastructure requirements, and the long-term regional condition of groundwater in the component's vicinity.

The groundwater storage components are separated into two regions, groundwater storage north of the Delta and groundwater storage south of the Delta. The general locations of each of the groundwater storage components are shown in Figure 2.

Appendix B contains attribute matrices for each of the groundwater storage components identified in Table 2. The attribute matrices contain all of the information included in Table 2, along with additional information available on the component's description, potential operations,

capacity, estimated cost, and other issues. The attribute matrices also contain a listing of the references used to compile the information presented.

North of the Delta

Groundwater storage components identified north of the Delta are exclusively conjunctive use operations developed through in-lieu exchange of surface water and groundwater or through spreading operations. There are a total of nine components in this region. Four components are located in the northern portion of the Sacramento Valley and generally represent areas that have nearly or completely full groundwater basins. There is significant potential for development of groundwater resources in this area. However, the development of groundwater resources must be linked with assurances that local impacts and local water resources development requirements are adequately addressed.

Groundwater storage components located in the southern Sacramento Valley include areas where the basins are typically more dewatered than those in the north. Many of these basins are stable and offer significant potential for the development of conjunctive use programs which could provide dry period reliability for the State's water resources system.

South of the Delta

To the south of the Delta, a total of eight groundwater basins have been identified (Table 2). A majority of these groundwater components overlie areas that are presently dewatered. In the areas south of the Delta, groundwater banking opportunities are more prevalent (three of the eight components). The existence of dewatered aquifer space provides an opportunity to store surplus flows diverted from the Delta or from the San Joaquin River or its tributaries. Water stored in these dewatered aquifers could be extracted to meet demands during dry periods. Groundwater extractions could be made for in-lieu uses or reducing demands for water diversions

from the Delta or the San Joaquin River. Groundwater could also be extracted for use in the California Aqueduct, which could reduce the demand for Delta diversions during critical periods.

The direct environmental impacts from developing a groundwater storage program are generally less than the impacts of developing new or expanded surface storage facilities due to fewer land use changes. The implementation of groundwater programs, however, is dependent on identifying and addressing the complex issues surrounding groundwater management and potential third-party impacts.

CONVEYANCE COMPONENTS

The inventory of conveyance components includes conveyance facilities which either move water from north of the Delta to south of the Delta or move water into or out of surface or groundwater storage facilities. A total of 26 conveyance components have been identified and are listed in Table 3.

The conveyance components have been separated into three categories: (1) conveyance facilities which convey water to storage facilities north of the Delta, (2) conveyance facilities which move water to storage facilities south of the Delta, and (3) Delta conveyance facilities. The general locations of the conveyance facilities are shown in Figure 3.

Appendix C contains attribute matrices for each of the conveyance facilities listed in Table 3. The attribute matrices contain all the information in Table 3, along with additional information on the component's description, operation, capacity, and estimated cost, as well as information on environmental and other issues. The attribute matrices also contain a listing of references used to compile the information presented.

Conveyance to Storage North of the Delta

A total of ten conveyance components which would convey water to storage facilities in the Sacramento Valley have been identified. Nine of these conveyance components could convey surplus Sacramento River flows to new storage facilities on the west side of the Sacramento Valley. The remaining component conveys Feather River flows across the Sacramento Valley to westside storage facilities. The success of new off-stream storage on the west side of the Sacramento Valley is linked to the construction of new conveyance facilities or the expansion of existing conveyance facilities, namely the Tehama-Colusa or Glenn-Colusa Canal. The new conveyance facilities in this category range from new diversions on the Sacramento River that convey water to storage facilities in the western foothills of the Coastal Range, to large-scale facilities which would convey surplus storage in Shasta Lake along the Coastal Range linking to new off-stream storage facilities and ultimately across the Delta to Clifton Court Forebay.

Conveyance to Storage South of the Delta

Eight conveyance components would convey water to storage facilities in the San Joaquin Valley (Table 3). These conveyance components are more diverse than those identified in the Sacramento Valley. These facilities include increasing the capacity of the Delta-Mendota Canal as part of the Mid-Valley Canal Project for delivery to areas where groundwater storage programs might be undertaken. Other conveyance facilities have been identified which would convey available water from the east side of the San Joaquin Valley to the California Aqueduct and/or the Delta-Mendota Canal. An additional component has been identified to move flows from the central Sierra region (American River to the Stanislaus River), south along the foothills of the Sierra Nevadas to the Tulare Lake Basin. Some of the most promising conveyance components in the San Joaquin Valley are those that would improve the ability to move water to and from new, expanded, or existing groundwater banking programs.

Delta Conveyance

Delta conveyance components would serve to convey water from north of the Delta to south of the Delta. The eight conveyance components in this category (Table 3) range from improvements to existing Delta channels to the construction of an isolated transfer facility. Several different alignments and configurations for an isolated facility have been identified. These alignments include the alignment of the original Peripheral Canal Project, a tunnel crossing in the western Delta, and a chain of lakes configuration that would link a series of new Delta island storage facilities, via siphons, from the Delta Cross Channel to Clifton Court Forebay.

III. CONCLUSIONS

A wide range of storage and conveyance components has been identified in the component inventories presented in this technical memorandum and accompanying appendices. The appendices contain preliminary assessments of the components' ability to meet some of the objectives of the Program. These assessments will be the subject of continued reevaluation as additional information on the components is compiled. These assessments are provided as a way to make initial comparisons of components. No component has been eliminated based on these assessments, and no attempt was made to use the assessments to rank or order the components relative to one another.

As the Program moves through Phase II, the storage and conveyance inventories will be used as the starting point for necessary screening of storage and conveyance facilities for the Programmatic EIR/EIS and, eventually, the site-specific environmental documentation required to implement the preferred alternative.

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Table 1
Surface Storage Component Inventory

Component	Location	Map Location	Type	Description	Storage Capacity
West Side Sacramento Valley					
Clair Engle Lake Enlargement	Trinity County Trinity River	6	Enlarged Existing On-Stream Storage	Develop in conjunction with pump/conveyance facility; transports Shasta storage to Clair Engle.	Additional 4,800 TAF (G)
Colusa Reservoir Complex	Colusa/Glenn Counties Funks Creek	9	Off-Stream Storage	Storage for new westside canal and Sacramento River flows.	3,000 TAF (G) 2,900 TAF (A)
Cottonwood Creek Reservoir Complex	Tehama/Shasta Counties Cottonwood Creek	11	Combined On-stream and Off Stream Storage	Storage for new westside canal and Sacramento River flows. Includes Dutch Gulch and Tehama Reservoirs.	1,600 TAF (G)
Fiddlers Reservoir	Tehama/Shasta Counties M.F. Cottonwood Creek	17	On-Stream Storage	Storage for new westside canal and Sacramento River flows.	310 to 545 TAF (G) 270 to 388 TAF (A)
Gallatin Reservoir	Tehama County Elder Creek	20	On-Stream Storage	Increase regulating capabilities and yield opportunities.	183 TAF (G) 176 TAF (A)
Glenn Reservoir	Glenn/Tehama Counties Stony Creek	23	Off-Stream Storage	Storage for Tehama-Colusa Canal or new westside canal.	8,206 TAF (G)
Hulen Reservoir	Shasta County N.F. Cottonwood Creek	24	On-Stream Storage	Increase regulating capabilities and yield opportunities.	96 to 244 TAF (G) 93 to 180 TAF (A)
Lake Berryessa Enlargement	Napa County Putah Creek	4	Off-Stream Storage	Storage for North Bay Aqueduct and/or new westside canal.	Existing-1,600 TAF (G) Additional-11,400 TAF (G)
Red Bank Project (Dippingvat-Schoenfield Project)	Tehama County S.F. Cottonwood Creek	40	Off-Stream Storage - Schoenfield Reservoir; On-Stream Storage - Dippingvat Reservoir	Provide flood control and water supply opportunities.	Dippingvat-104 TAF(G) Schoenfield-250 TAF(G)
Rosewood Reservoir	Shasta/Tehama Counties Salt Creek and Dry Creek	42	On-Stream Storage	Increase regulating capabilities and yield opportunities.	155 TAF (G)
Shasta Lake Enlargement	Shasta County Sacramento River	43	On-Stream Storage	Increase regulating capabilities and yield opportunities.	Additional 9,750 TAF (G) (4,550 TAF existing) (G)
Sites Reservoir	Colusa and Glenn Counties Funks & Stone Corral Cks	44	Off-Stream Storage	Storage for Tehama-Colusa Canal or new westside canal.	1,200 to 1,800 TAF (G) 1,160 to 1,760 TAF (A)
Thomes-Newville Reservoir	Glenn County Thomes & Stoney Creek	48	Off-Stream Storage	Storage for Tehama-Colusa Canal or new westside canal.	1,841 TAF (G)

Table 1
Surface Storage Component Inventory

Component	Location	Map Location	Type	Description	Storage Capacity
East Side Sacramento Valley					
Allen Camp Reservoir	Modoc County Pit River	1	On-Stream Storage	Increase regulating capabilities and yield opportunities.	195.6 TAF (G) 185 TAF (A)
Auburn Reservoir	Placer County N.F. American River	2	On-Stream Storage	Increase regulating capabilities and yield opportunities.	315 to 2,300 TAF (G) @2,300 TAF (G)
Bella Vista Reservoir	Shasta County Little Cow Creek	3	On-Stream Storage	Increase regulating capabilities and yield opportunities in the northern Sacramento Valley.	139 TAF (A) 146 TAF (G)
Coloma Reservoir	El Dorado County S.F. American River	8	On-Stream Storage	Increase regulating capabilities and yield opportunities.	710 TAF (G)
Deer Creek Meadows Reservoir	Tehama County Deer Creek	12	On-Stream Storage	Increase regulating capabilities and yield opportunities.	200 TAF (G) 178 TAF (A)
Folsom Reservoir Enlargement	El Dorado, Placer, and Sacramento Counties American River	18	Enlarged Existing On-Stream Storage	Increase regulating capabilities and yield opportunities.	Additional 366 TAF (G) (974 TAF existing) (G)
Freemans Crossing Reservoir	Yuba/Nevada Counties Middle Yuba River	19	On-Stream Storage	Increase regulating capabilities and yield opportunities.	300 TAF (G) 295 TAF (A)
Garden Bar Reservoir	Sutter County Bear River	21	On-Stream Storage	Provide water supply opportunities in conjunction with Camp Far West and Oroville Reservoirs.	245 TAF (G)
Kosk Reservoir	Shasta County Pit River	27	On-Stream Storage	Increase regulating capabilities and yield opportunities.	800 TAF (G)
Marysville Reservoir	Yuba County Yuba River	31	On-Stream Storage	Increase regulating capabilities and yield opportunities from the Yuba River.	916 TAF (G) 896 TAF (A)
Millville Reservoir	Shasta County South Cow Creek	33	On-Stream Storage	Increase regulating capabilities and yield opportunities.	206 TAF (G) 200 TAF (A)
Squaw Valley Reservoir	Shasta County Squaw Valley Creek	46	Combined Off-Stream and On-Stream Storage	Storage for Sacramento River flows.	400 TAF (G)
Tuscan Buttes Reservoir	Tehama County Paynes & Inks Creeks	49	Off-Stream Storage	Surplus flows from the Sacramento River would be diverted into a forebay-afterbay adjacent to the river from which water would be pumped into Tuscan Reservoir.	3,675 to 5,500 TAF (G)
Waldo Reservoir	Yuba County Dry Creek	50	Off-Stream Storage	Storage for Yuba River flows.	60 to 300 TAF (G)

Table 1
Surface Storage Component Inventory

Component	Location	Map Location	Type	Description	Storage Capacity
Wing Reservoir	Shasta County Inks Creek	51	On-Stream Storage	Increase regulating capabilities and yield opportunities.	244 TAF (G)
In-Delta					
Chain of Lakes Facility	Sacramento/San Joaquin Delta	5	Island Storage in Delta	A chain of contiguous island storage facilities from the north Delta to the export Facilities.	300 to 600 TAF
In-Delta Storage	Sacramento/San Joaquin Delta	14	Island Storage in Southern Delta	Island storage in the southern Delta for surplus Delta flows.	230 TAF
South-of-Delta Aqueduct Storage					
Garzas Reservoir	Stanislaus County Garzas Creek	22	Off-Stream Storage	Off-aqueduct storage for the California Aqueduct or the Delta-Mendota Canal.	139 to 1,754 TAF (A)
Ingram Canyon	Stanislaus County Ingram Creek	25	Off-Stream Storage	Off-aqueduct storage for the California Aqueduct or the Delta-Mendota Canal.	333 to 1,201 TAF (A)
Kettleman Plain	Kings County Kettleman Hill	26	Off-Stream Storage	Off-aqueduct storage for the California Aqueduct or the Delta-Mendota Canal.	133 to 283 TAF (A)
Little Salado-Crow Reservoir	Stanislaus County Crow Creek	28	Off-Stream Storage	Off-aqueduct storage for the California Aqueduct or the Delta-Mendota Canal.	132 to 250 TAF (A)
Los Banos Grandes	Merced County Los Banos Creek	29	Off-Stream Storage	Off-aqueduct storage for the California Aqueduct or the Delta-Mendota Canal.	276 to 2,000 TAF (A)
Los Vaqueros Enlargement	Contra Costa County Kellogg Creek	30	Off-Stream Storage	Off-aqueduct storage for the California Aqueduct or the Delta-Mendota Canal.	Additional 200 TAF (G) (100 TAF (G) under construction)
Orestimba Reservoir	Stanislaus County Orestimba Creek	36	Off-Stream Storage	Off-aqueduct storage for the California Aqueduct or the Delta-Mendota Canal.	295 to 1,137 TAF (A)
Panoche Reservoir	Fresno County Silver Creek	37	Off-Stream Storage	Off-aqueduct storage for the California Aqueduct or the Delta-Mendota Canal.	158 to 2,647 TAF (A)
Quinto Creek Reservoir	Merced/Stanislaus County Quinto Creek	39	Off-Stream Storage	Off-aqueduct storage for the California Aqueduct or the Delta-Mendota Canal.	332 to 381 TAF (A)
Romero Reservoir	Merced County Romero Creek	41	Off-Stream Storage	Off-aqueduct storage for the California Aqueduct or the Delta-Mendota Canal.	184 TAF (A)
Sunflower Reservoir	Kings/Kern Counties Avenal Creek	47	Off-Stream Storage	Off-aqueduct storage for the California Aqueduct or the Delta-Mendota Canal.	322 to 535 TAF (A)

Table 1
Surface Storage Component Inventory

Component	Location	Map Location	Type	Description	Storage Capacity
San Joaquin Valley					
Clay Station	Sacramento County Laguna Creek	7	Off-Stream Storage	Storage for American River flows.	170 TAF (G)
Cooperstown Reservoir	Stanislaus County	10	Off-Stream Storage	Storage for Stanislaus and Tuolumne River flows.	609 TAF (G)
Deer Creek Reservoir	Sacramento County near Rancho Murietta	13	Off-Stream Storage	Storage for American River flows.	600 TAF (G)
Duck Creek Reservoir	San Joaquin County Calaveras watershed	15	Off-Stream Storage	Storage for Mokelumne and Calaveras River flows.	100 TAF (G)
Farmington Reservoir Enlargement	San Joaquin County Littlejohns Creek	16	Combined On-Stream and Off-Stream Storage	The existing reservoir would be improved for conservation storage of surplus Stanislaus River flows conveyed through the Upper Farmington Canal.	100 TAF (A)
Millerton Lake Enlargement	Fresno County San Joaquin River	32	On-Stream Storage	Increase flow regulating opportunities.	520 to 1,400 TAF
Montgomery Reservoir	Stanislaus County Dry Creek	34	Off-Stream Storage	Capture and store spills from Lake McClure.	240 TAF (G)
Nashville Reservoir	El Dorado/Sacramento Counties - Cosumnes Riv	35	Combined Off-Stream and On-Stream Storage	Storage for Cosumnes River flows.	900 TAF (G)
Pardee Reservoir Enlargement	Calaveras/Amador Counties Mokelumne River	38	On-Stream Storage	Increase regulating capabilities and yield opportunities.	Additional 150 TAF (G) (210 TAF existing) (G)
South Gulch Reservoir	San Joaquin County South Gulch tributary to Calaveras River	45	Off-Stream Storage	Store flows from the Calaveras and Stanislaus Rivers.	180 TAF (G)

(A) = Active Storage Capacity
(G) = Gross Storage Capacity

Table 2
Groundwater Storage Component Inventory

Component	Location	Map Location	Type of Operation	Estimated Storage Capacity: Gross[1] (Depth Range) (1,000 af / ft-ft)	Estimated Storage Capacity: Active[2] Capacity (1,000 af)	Operation to Exceed Historical Depth (Yes / No)	Additional Infrastructure Required: Conveyance (cfs)	Additional Infrastructure Required: Recharge/ Distribution (cfs)	Additional Infrastructure Required: Extractions (cfs)	Long-Term Regional Condition	Other
Groundwater Storage North of Delta											
Butte Basin	Butte County	1	Conjunctive use	960/(30-150)	470	Yes	No	210	260	Full	Appreciable effect on Feather River accretion
Cache Creek Fan	Yolo County	2	Conjunctive use	1230/(30-150)	450	Yes	250	250	250	Dewatered space available	Remote basin with little river accretion impact
Colusa County	Arbuckle area	3	Conjunctive use	885/(30-300)	320	Yes	No	180	180	Stable	Remote basin with little river accretion impact
Eastern Sutter County	Sutter County east of Feather River	4	Conjunctive use	1020/(30-200)	280	Yes	No	150	150	Stable	Appreciable effect on Feather-Sacramento Rivers accretions
Sacramento County	Sacramento County south of American River	5	Conjunctive use	560/(30-150)	260	Yes	No	140	90	Dewatered space available	Isolated basin with little river accretion impact
Stony Creek Fan	Glenn County Stony Creek	6	Conjunctive use	1,370/(30-150)	640	Yes	No	360	360	Full	Remote basin with little river accretion impact
Sutter County	South of Sutter Buttes	7	Conjunctive use	2,320/(30-200)	1,180	Yes	No	430	660	Stable	
Thomes Creek Fan	Tehama County Thomes Creek	8	Conjunctive use	580/(30-200)	220	Yes	No	120	120	Full	Remote basin with little river accretion impact
Yuba County	Yuba County - south of the Yuba River	9	Conjunctive use	540/(20-100)	280	No	No	160	0[3]	Stable dewatered	Appreciable effect on Feather River accretion
Groundwater Storage South of Delta											
Folsom So. Canal Extension Area	San Joaquin County	10	Conjunctive use	1,800 (30-130)	740	Yes	400	400	400	Dewatered space available	San Joaquin River accretions would increase
James ID/Raisin City WD, Mid-Valley Canal Reaches 1-3	Central Fresno County	11	Conjunctive use	9,200/(50-300)	800	Yes	440	440	440	Dewatered space available	Minor reduction in loss from San Joaquin River
Kern River Fan	Kern County	12	Groundwater banking	1,200/(50-250)	930	Yes	1,000	500	200	Dewatered space available	Existing storage is full and fully committed

Table 2
Groundwater Storage Component Inventory

Component	Location	Map Location	Type of Operation	Estimated Storage Capacity: Gross[1] (Depth Range) (1,000 af / ft-ft)	Estimated Storage Capacity: Active[2] Capacity (1,000 af)	Operation to Exceed Historical Depth (Yes / No)	Additional Infrastructure Required: Conveyance (cfs)	Additional Infrastructure Required: Recharge/ Distribution (cfs)	Additional Infrastructure Required: Extractions (cfs)	Long-Term Regional Condition	Other
Madera Ranch	Madera County	13	Groundwater banking	800/(20-100)	350	No	400	400	200	Dewatered space available	Minor reduction in loss from San Joaquin River
Mendota Pool - No. Branch Mid-Valley	Madera County	14	Conjunctive use	9,000/(50-200)	900	Yes	500	500	500	Dewatered space available	San Joaquin River accretions would increase
Mojave River Basins	San Bernardino	15	Groundwater banking	1,800/(na)	200	No	100	100	0	Dewatered space available	Only about 200 taf of storage could be recovered in 1928-34
Semitropic WSD	Kern County	16	Conjunctive use	4,100/(170-470)	1,000	Yes	500	230	150	Dewatered space available	Project is 1/3 committed to existing participants
Tuolumne-Merced Basins	Stanislaus and Merced Counties	17	Conjunctive use	3,050/(20-100)	1,250	Yes	No	No	690	Stable	

[1] Gross storage is calculated from estimated area, depth, and specific yield estimates.

[2] Unless calculated as part of previous studies, the active storage is the lesser of either the estimated exchangeable supply or the volume of a half-ellipsoid fitted within the project area and depth range times the specific yield. These are theoretical values. Any specific project proposals would be developed in close coordination with agencies to ensure that operational impacts are fully addressed.

[3] Existing extraction facilities would enable operation.

Table 3
Conveyance Component Inventory

Component	Location	Conveyance Facility Map Location	Type	Description	Conveyance Capacity
Conveyance to Storage North of the Delta					
Berryessa Intertie	Sacramento River to Lake Berryessa	1	New conveyance facility	Water would be pumped from the Sacramento River to Lake Berryessa.	5,000 cfs
Chico Landing Intertie	Sacramento River to Tehama Colusa Canal	3	New conveyance facility	This conveyance facility would convey water from the Sacramento River to the Tehama-Colusa Canal where it would be pumped to off-stream storage.	5,000 cfs
Glenn County Reservoirs to Lake Berryessa Conveyance Facility	Connects proposed Glenn county reservoirs to Lake Berryessa	9	New conveyance facility	Water would be conveyed by tunnel from proposed reservoirs in Glenn County to Lake Berryessa.	10,000 cfs
Keswick-Cottonwood Tunnel	Keswick Reservoir to proposed Cottonwood Creek storage facilities	13	New conveyance facility	Tunnel would deliver available flows from Keswick Reservoir to proposed Cottonwood Creek storage facilities.	10,000 cfs
Oroville Intertie (Cross Valley Conduit)	Lake Oroville to the Tehama-Colusa Canal	17	New conveyance facility	Multiple large-diameter pipelines would convey available flows from Lake Oroville to off-stream storage facilities on the west side of the Sacramento Valley.	5,000 cfs
Shasta-Clair Engle Tunnel	Shasta Lake to Clair Engle Lake	19	New conveyance facility	Tunnel would deliver available storage from Shasta Lake to Clair Engle Lake.	10,000 cfs
Tehama-Colusa Canal Enlargement	Red Bluff Diversion to canal terminus	21	Enlarged existing conveyance facility	Increase the capacity of the canal from Red Bluff Diversion to the terminus of the canal to 5,000 cfs. The extent of the enlargement depends on the off-stream storage facility being served.	5,000 cfs
Tehama-Colusa Canal Extension	From the existing terminus to Solano County	22	Expanded existing conveyance facility	The existing Tehama-Colusa Canal would be extended from its present terminus to the proposed Lake Berryessa Winters Pumping Plant.	5,000 cfs
Westside Sacramento Valley Conveyance, Alternative A	Shasta Lake to proposed reservoirs on the west side of the Sacramento Valley	24	New conveyance facility	Connects Shasta Lake with proposed reservoirs on the west side of the Sacramento Valley to move excess storage from Shasta Lake to off-stream storage facilities. Alignment would be along the Coastal Range.	10,000 cfs

Table 3
Conveyance Component Inventory

Component	Location	Conveyance Facility Map Location	Type	Description	Conveyance Capacity
Westside Sacramento Valley Conveyance, Alternative B	Shasta Lake to proposed Sites Reservoir	25	New conveyance facility	Connects Shasta Lake with proposed reservoirs on the west side of the Sacramento Valley to move excess storage from Shasta Lake to off-stream storage facilities. Alignment would be parallel to the Sacramento River on the valley floor.	10,000 cfs
Conveyance to Storage South of the Delta					
Delta-Mendota Canal	Clifton Court Forebay to Mendota Pool	4	Enlarged existing conveyance facility	Increased canal capacity would deliver water to the proposed Mid-Valley Canal--North Branch and Main Branch.	2,000 cfs
East Side Canal	Folsom South Canal to Merced River	5	New conveyance facility	Would convey American and Sacramento River water to the San Joaquin Valley, terminating at the San Joaquin River.	5,000 cfs
East Side Canal Extension	Merced River to Kern River	6	New conveyance facility	Would extend the proposed East Side Canal to the Kern County line and potentially to the Cross Valley Canal to deliver water to the California Aqueduct.	5,000 cfs
Friant-Kern Canal Enlargement	Friant-Kern Intertie (junction point south of Kings River) to White River	8	Enlargement of conveyance facility	The Mid-Valley Canal, Main Branch Intertie would connect the Mendota Pool to the Friant-Kern Canal. Enlargement of the Friant-Kern Canal would be required to accommodate the additional flows from the intertie.	1,500 cfs
Mid-Valley Canal (Main Branch Intertie)	Mendota Pool to Friant-Kern Intertie	16	New conveyance facility	Canal would deliver water from the Mendota Pool to the Friant-Kern Canal. The Friant-Kern Canal would need to be enlarged as part of this alternative.	1,500 cfs
Mid-Valley Canal (Main Branch)	Mendota Pool to White River	14	New conveyance facility	The main branch of the Mid-Valley Canal would go south from Mendota Pool down the center of the east side of the valley and terminate at White River.	1,500 cfs
Mid-Valley Canal (North Branch)	Mendota Pool to Chowchilla	15	New conveyance facility	The North Branch would divert water out of Mendota Pool to a terminus at the Chowchilla River.	500 cfs

Table 3
Conveyance Component Inventory

Component	Location	Conveyance Facility Map Location	Type	Description	Conveyance Capacity
San Joaquin East-West Aqueduct	Merced River to California Aqueduct and Delta-Mendota Canal	18	New conveyance facility	The Newman Wasteway would be converted to a water supply aqueduct with an intake on the Merced River. A series of low-lift pumping plants would lift the water to the Delta-Mendota Canal or the California Aqueduct.	4,300 cfs
Delta Conveyance					
Chain of Lakes Isolated Facility	Sacramento River in North Delta to Clifton Court Forebay	2	New conveyance facility	A chain of Delta islands would be converted into water storage reservoirs, connected by large inverted siphons. The chain of lakes would act as an isolated Delta conveyance facility and a storage facility.	15,000 cfs
Folsom South Canal Enlargement/Extension	Folsom South Canal at Hood-Clay Canal to proposed East Side Canal	7	Enlargement and extension of existing conveyance facility	The Folsom South Canal would be extended to the proposed East Side Canal (Littlejohns Creek) and its capacity would be increased.	7,000-5,500 cfs
Hood-Clay Canal	Sacramento River at Hood--Freeport to Folsom South Canal	10	New conveyance facility	A new conveyance facility would link the Sacramento River with the Folsom South Canal via a diversion near Hood on the Sacramento River.	5,000 cfs
Improved Through-Delta Conveyance	North and south Delta	11	Improve existing Delta channels	The channel capacity of selected Delta channels would be increased by dredging and levee setbacks to increase the ability to move water from the north Delta to the CVP and SWP Delta export facilities.	Variable
Isolated Delta Conveyance Facility, Canal	Sacramento River at Hood--Freeport to Clifton Court Forebay	12 a	New conveyance facility	A 42-mile canal with a screened intake in the Hood or Freeport area on the Sacramento River. The canal would convey water directly to Clifton Court Forebay and would include siphon crossings of major Delta channels.	5,000, 10,000 and 15,000 cfs
Isolated Delta Conveyance Facility, Pipeline	Sacramento River at Hood--Freeport to Clifton Court Forebay	12 b	New conveyance facility	A 42-mile buried pipeline with a screened intake in the Hood or Freeport area on the Sacramento River. The pipeline would convey water directly to Clifton Court Forebay and would include siphon crossings of major Delta channels.	5,000 cfs

Table 3
Conveyance Component Inventory

Component	Location	Conveyance Facility Map Location	Type	Description	Conveyance Capacity
Ship Channel Conveyance	Upstream of Bryte to Isolated Conveyance Facility	20	New conveyance facility	The Sacramento Ship Channel would serve as part of a conveyance system which would convey water from the Sacramento River to Clifton Court Forebay. The facility would include a tunnel crossing of the Delta in the western Delta area.	5,000, 10,000 and 15,000 cfs
Upper Eastside Foothills Conveyance Facility	Sacramento River (upstream of Feather River confluence) and Feather River (upstream of Sacramento River confluence) to Eastside Canal or Folsom South Canal	23	New conveyance facility	Screened diversions on Sacramento River and Feather River would convey 7,000 cfs through a new conveyance facility at the Folsom South Canal.	7,000 cfs

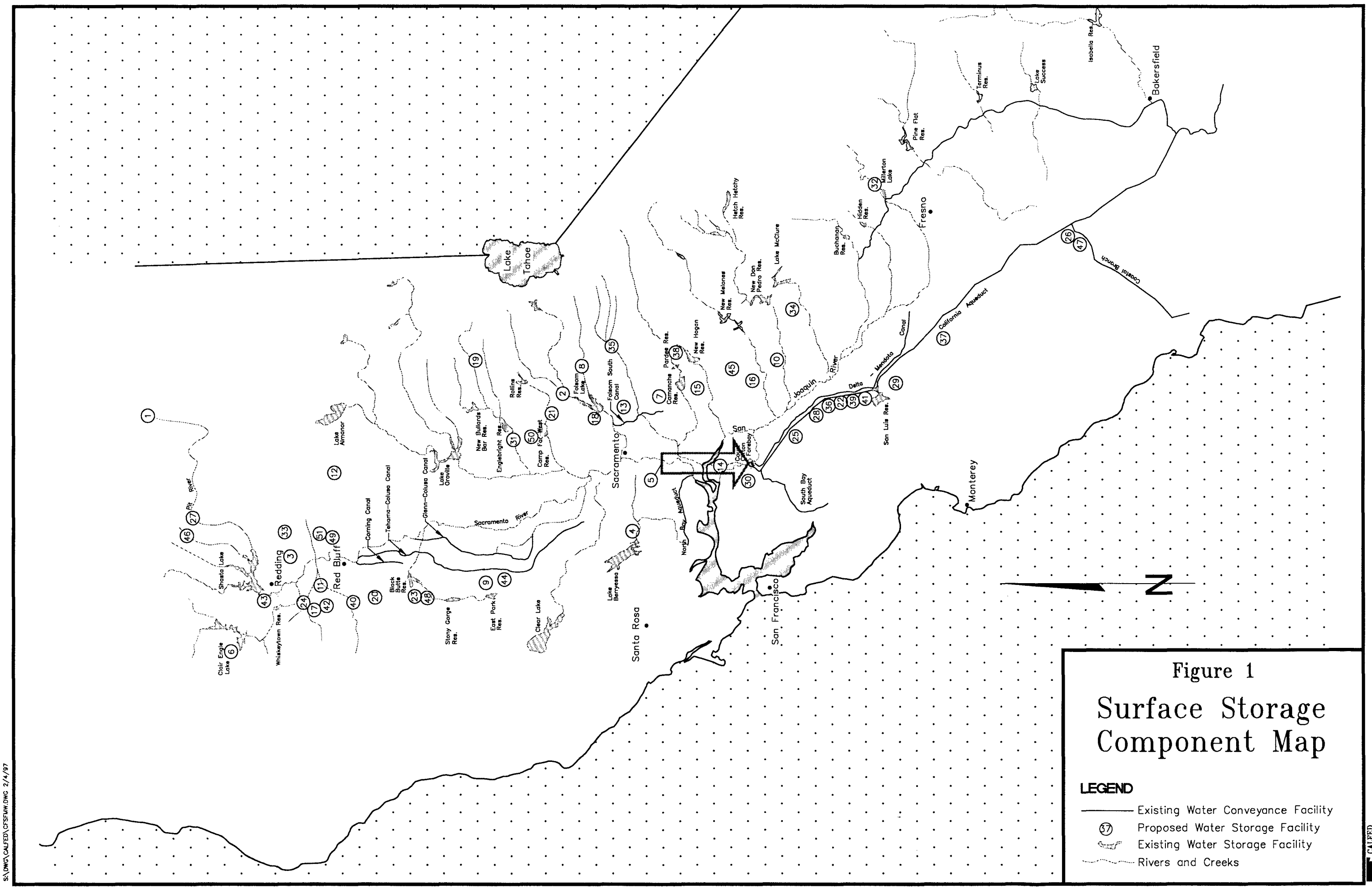

Figure 1

Surface Storage Component Map

LEGEND

- Existing Water Conveyance Facility
- (37) Proposed Water Storage Facility
- Existing Water Storage Facility
- Rivers and Creeks

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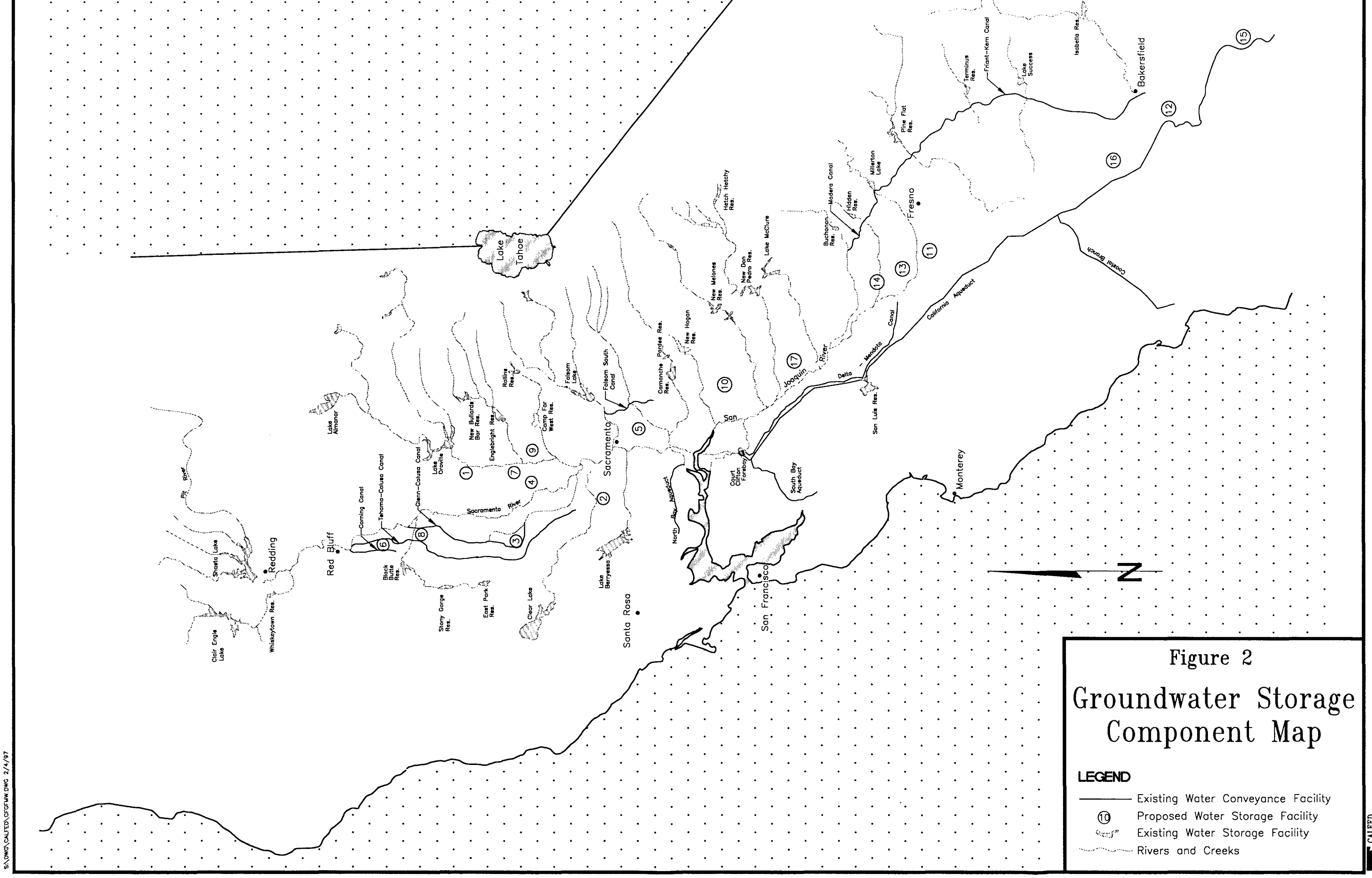
Lake Tahoe
Lake Almanor
Pit River
New Bullards Bar Res.
Englebright Res.
Camp Far West Res.
Rollins Res.
Folsom Lake
Folsom South Canal
Camanche Res.
New Hogan Res.
New Melones Res.
New Don Pedro Res.
Lake McClure
Hetch Hetchy Res.
Buchanan Res.
Madera Canal
Hidden Res.
Millerton Lake
Pine Flat Res.
Terminus Res.
Friant-Kern Canal
Lake Success
Isabella Res.
Bakersfield
Fresno
Coastal Branch
California Aqueduct
Delta - Mendota Canal
San Luis Res.
Joaquin River
Sacramento
San
Monterey
Court Clifton Forebay
South Bay Aqueduct
North Bay Aqueduct
Lake Berryessa
Santa Rosa
San Francisco
Corning Canal
Tehama-Colusa Canal
Glenn-Colusa Canal
Lake Oroville
Sacramento River
Shasta Lake
Redding
Red Bluff
Black Butte Res.
Stony Gorge Res.
East Park Res.
Clear Lake
Clair Engle Lake
Whiskeytown Res.
N
Figure 2
Groundwater Storage Component Map
LEGEND
Existing Water Conveyance Facility
Proposed Water Storage Facility
Existing Water Storage Facility
Rivers and Creeks
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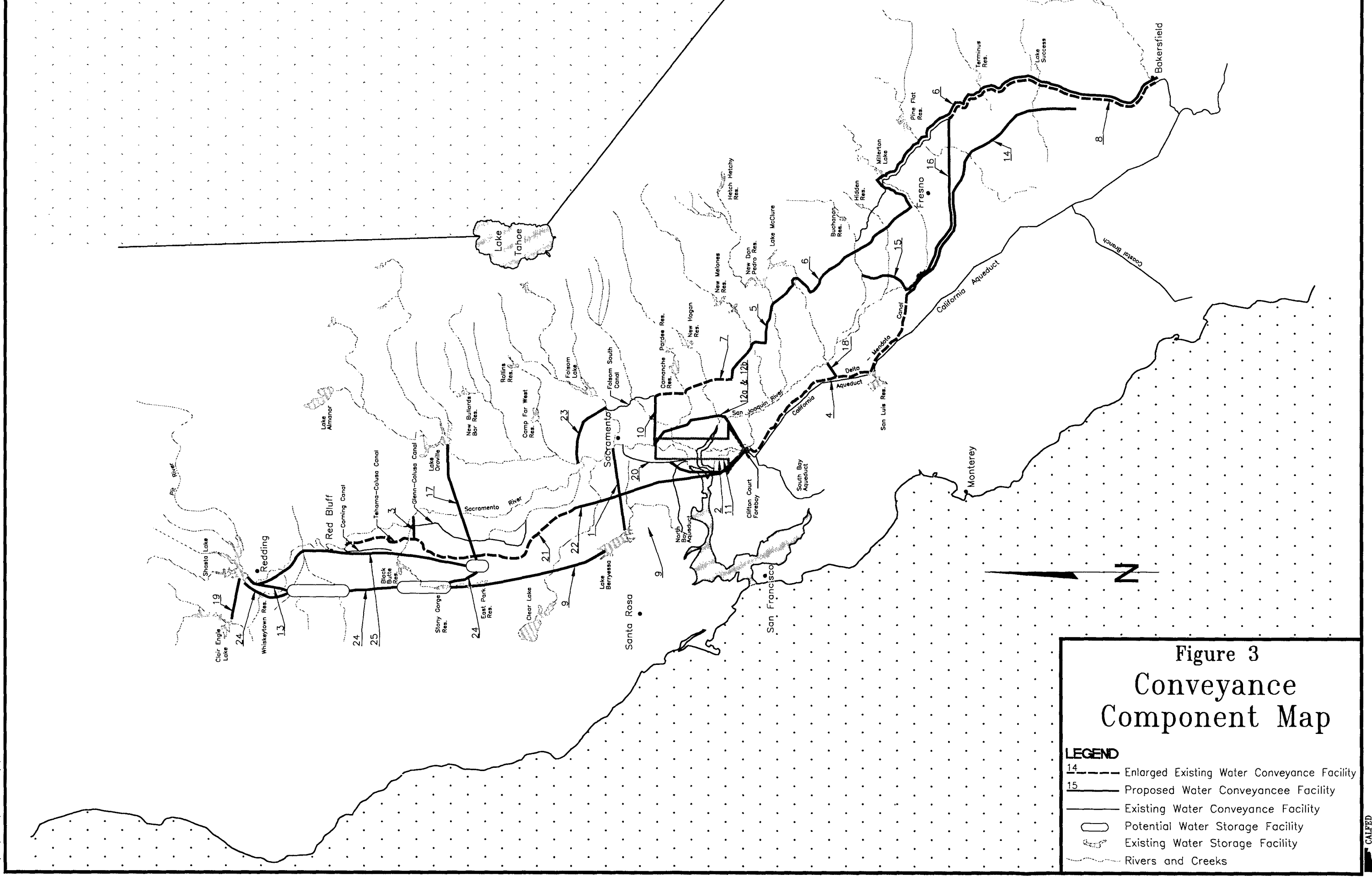

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Appendix A
Surface Storage Attribute Matrices

Preliminary Working Draft
CALFED Bay-Delta Program
Storage and Conveyance Component Inventories

February 28, 1997

INTRODUCTION

Appendix A of the technical memorandum on *Storage and Conveyance Component Inventories* provides attribute matrices for each of the surface storage components identified in the Surface Storage Components section of the technical memorandum. The attribute matrices contain information on the various attributes or characteristics of surface storage components, such as location, component description, storage capacities, estimated cost, and other characteristics. The purpose of this information is to provide CALFED with a full range of potential surface storage components to be considered in the formulation of storage and conveyance alternatives developed in Phase II of the CALFED process.

Surface storage components and the information for the attribute matrices have been identified from past and current investigations. In nearly all instances, information for one or more of the attributes was not available in existing reports or studies. As the investigation of storage and conveyance alternatives continues, selected surface storage components will be investigated in greater detail.

The inclusion of any particular surface storage component does not represent an endorsement of that component by CALFED. The surface storage components identified in the technical memorandum on Storage and Conveyance Component Inventories and the information presented within this appendix represent surface storage projects which have been investigated or are being investigated and which have the potential to contribute to the objectives of the CALFED Program.

DESCRIPTION OF ATTRIBUTE MATRICES

The attribute headings for the surface storage component attribute matrices vary slightly from the attribute headings for the groundwater storage and conveyance matrices. Presented below are the attribute headings, with explanations, that have been used for the surface storage components.

Name of Component - This attribute identifies the name of the component. In most instances, the names refer to the waterway on which the storage facility is or would be located.

Location - Identifies the county(ies) in and the waterway(s) on which the storage facility would be located.

Surface Storage Map Location - Identifies the map location number of the surface storage component used in Figure 1 of the technical memorandum on *Storage and Conveyance Inventories.*

Type of Storage Facility - Describes the type of storage facility represented by the component. The types of storage components included in the surface storage component inventories are enlargement of off-stream storage, new off-stream storage, enlargement of on-stream storage, and new on-stream storage. In some cases, an on-stream storage facility would function as off-stream storage for another waterway. Such cases are noted.

Component Description - The description of a storage facility includes more specific information regarding the location of the dam, the waterway(s) that may be affected, and a description of the originally proposed operation or purpose of the facility if available. A brief discussion of the potential utilization of the facility for CALFED objectives may also be included in this description.

Storage Capacity(ies) - The capacity for storage facilities is described in thousands of acre-feet (taf) of gross storage capacity and/or active capacity. If a storage facility has been studied at various capacities, several entries may be listed under this heading.

Constructibility - This heading describes important issues related to the constructibility of the proposed project. For example, the need to relocate major infrastructure, the presence of faults, or the need for special features which might present an engineering or construction challenge are identified.

Construction Time - This category includes an estimate of the time required for construction. This time estimate is not intended to refer to "implementation time," which would entail the time to develop appropriate environmental documentation and permitting, completion of a public review process, and construction time.

Cost - The cost of a component is separated into estimated capital and annual costs. It should be noted that the capital costs for the various components are comprised of varying elements (construction, engineering, legal, property, and environmental), depending upon the source(s) of information for the previous cost estimate. All cost elements are not available for all components; therefore, the capital costs for the various components are not comparable. The capital costs are adjusted to January 1996 dollars using the U.S. Bureau of Reclamation Construction Cost Trends updated to January 1996. The annual costs represent annual O&M costs estimated from prior studies and adjusted to January 1996 dollars using the Consumer Price Index. The general procedure for escalating the cost of facilities is as follows:

- For off-stream reservoirs, the escalation values for the following items were averaged: earth dams, concrete dams, pumping plants, power plants, and property.
- For on-stream reservoirs, the escalation values for the following items were averaged: earth dams, concrete dams, power plants, and property.
- If O&M costs are not specified in previous studies, it was assumed that the annual O&M costs are 0.6 percent of the total capital cost.
- If costs are not available, no efforts were made to generate new cost estimates. Necessary new cost information will be generated in Phase II.

The cost information is derived from a wide range of studies with varying degrees of detail. Any comparison of the indexed costs presented within this appendix should be made with caution.

Cost/Acre-Foot - The cost per acre-foot of capacity was calculated using the capital cost divided by the active capacity of the facility. In the instances where the active capacity was unknown, the gross capacity was used.

Component-Specific Environmental Evaluation - This evaluation is a brief description of the environmental concerns associated with developing the proposed surface storage facility. The description is limited to the specific project/component and does not include indirect environmental impacts/benefits for the Bay-Delta system. This type of general evaluation is intended to allow components to be fairly evaluated against one another. The impacts of a given component and all other related components will be evaluated in the formal impact analysis of the EIR/EIS.

Issues

Legal and Institutional - This attribute generally describes the existence of legal or institutional issues that could hinder the development of the project; for example, the existence of water rights claims and mandated flow requirements.

Water Source - This attribute indicates the source of water for the component.

Site or Route Land Ownership and Use - The inundation area of a new or expanded surface storage facility indicates if there is overlap with lands that cannot be affected according to state and federal laws.

Socioeconomic - Socioeconomic impacts are qualified generally with regard to potential third-party impacts, changing land uses, or right-of-way considerations.

Preliminary Assessment Considerations - Components are assessed based on several general factors:

- The type of storage facility. The CALFED preference for storage facilities is as follows: (1) enlarged off-stream storage (highest); (2) new off-stream storage (high); (3) expanded on-stream storage (low); and (4) new on-stream storage (lowest).

- The ability of the project to increase water supply opportunities. Due to the undetermined nature of future project operations which would affect a project's ability to develop additional water supply opportunities, each component's ability to meet this assessment factor is defined as low, moderate, or high.

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- The ability of the project to improve the operational flexibility of the State's water resources system. Once again, due to the undetermined nature of future project operations, each component's ability to meet this criterion is defined as low, moderate, or high.

The assessment based on the above factors is very preliminary, relying on the information compiled to date in the attribute matrices. The intent of the assessment is to quickly determine which components are clearly not compatible with CALFED objectives.

References - The source or sources of information used to complete the attribute matrix are listed.

SURFACE STORAGE COMPONENT ATTRIBUTE MATRICES

Provided on the following pages are attribute matrices for each of the 51 surface storage components identified in Table 1 of the technical memorandum on *Storage and Conveyance Inventories*. The following attribute matrices are ordered alphabetically by the name of the component.

Name of Component: Allen Camp Reservoir

Location: Modoc County, Pit River approximately 11 miles north of the Lassen-Modoc County line

Surface Storage Map Location: 1

Type of Storage Facility: New on-stream storage

Component Description: Reservoir would store and regulate flows from the Pit River. The Pit River, which is generally depleted in late summer, would become a continuously flowing stream.[3]

Storage Capacity(ies): Active-185 TAF, gross-195.6 TAF[2]; active-179.2 TAF[3]

Constructibility: No significant constructibility issues identified.

Construction Time: Not determined.

Cost: Costs have been indexed to January 1996 dollars from the costs presented by DWR in 1957 (Reference 2) corresponding to an active storage capacity of 185 TAF.

Capital ($M): 28.7 (1955 cost-4.87)
Annual ($M): .17 (0.6% of capital cost)
Cost/Acre-Foot ($): 155 (based on active storage capacity)

Component-Specific Environmental Evaluation: Eighteen prehistoric and one historic sites. Inundate 24 miles of mostly warm stream habitat, 4,800 acres of primarily pine-juniper-sagebrush, grasslands, wet meadows, and irrigated pasture. Numerous antelope, deer, and geese will be eliminated. Presence of endangered Modoc sucker. Seven hundred acres of riparian habitat inundated.[1]

Issues

Legal and Institutional: Not determined.

Water Source: Pit River

Site or Route Land Ownership and Use: Not determined.

Socioeconomic: Not determined.

Preliminary Assessment Considerations

CALFED Program Preference by Surface Storage Type: Lowest; new in-stream storage

Potential to Contribute to Increases in Water Supply Opportunities: Low

Potential to Contribute to Operational Flexibility of the State's Water Resources System: Low

The runoff from the Pit River watershed above the proposed dam site is relatively low, which would result in potentially low yields. Pit River flows are currently stored in Shasta Lake.

References: [1]Department of Water Resources, September 1988, *Enlarged Shasta Wrap Up Report*, State of California.
[2]Department of Water Resources, May 1957, *The California Water Plan*, Bulletin No. 3, State of California.

[3]Anonymous, August 1982, *Enlarging Shasta Lake Feasibility Study, Description of Alternative Storage Facilities.*

Name of Component: Auburn Reservoir

Location: Placer County, North Fork American River at river mile 20.1

Surface Storage Map Location: 2

Type of Storage Facility: New on-stream storage

Component Description: Dam located below confluence of the north and middle forks of the American River. Reservoir would be operated in conjunction with Folsom Lake. Reservoir would provide flood protection (250 years for 2,300 TAF capacity reservoir), electric power operation, water supplies, and recreation.

Storage Capacity(ies): Dead storage for each reservoir alternative would be approximately 30 TAF; 315 to 2,300 TAF

Constructibility: Seismic considerations halted construction in 1975. No other significant constructibility issues have been identified.

Construction Time: 5.5 years

Cost: Cost estimates have been indexed to January 1996 dollars from cost presented by the Bureau of Reclamation in 1987 for a reservoir with gross capacity of 2,300 TAF and an active capacity of 2,270 TAF.

Capital ($M): 1,473 (1987 cost-1,148)
Annual ($M): 6.7
Cost/Acre-Foot ($): 649 (based on active storage capacity)

Component-Specific Environmental Evaluation: 43 to 48 miles of the north and middle forks of American River and 10,000 acres of the American River Canyon would be inundated for a 2,300 TAF capacity reservoir. Adverse environmental impacts have been termed unacceptable and unmitigable by the EPA, USFWS, and DFG.

Issues

Legal and Institutional: There have been significant legal and institutional challenges to this project which would need to be resolved prior to competion of the project. National environmental and taxpayer groups have vehemently opposed this project and should be expected to continue their opposition. Water agencies, developers and Congressional representatives strongly support this project.

Water Source: North Fork American River

Site or Route Land Ownership and Use: Combination of public and private lands

Socioeconomic: Not determined.

Preliminary Assessment Considerations

CALFED Program Preference by Surface Storage Type: Lowest; new on-stream storage

Potential to Contribute to Increases in Water Supply Opportunities: High

Potential to Contribute to Operational Flexibility of the State's Water Resources System: High

Auburn Reservoir has been intensely investigated over the past several decades and construction was begun on the reservoir, but never completed. The future development of Auburn Dam would require that significant institutional and environmental issues be overcome.

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References: Bureau of Reclamation, July 1987, *Auburn Dam Report*, Department of the Interior.

Name of Component: Bella Vista Reservoir

Location: Shasta County, Little Cow Creek

Surface Storage Map Location: 3

Type of Storage Facility: New on-stream storage

Component Description: This reservoir would store flows from Little Cow Creek.

Storage Capacity(ies): Active-138 TAF, gross-146 TAF

Constructibility: Not determined.

Construction Time: Not determined.

Cost: Cost estimates have been indexed to January 1966 dollars from costs presented by DWR in 1957 for a reservoir with a gross capacity of 146 TAF and an active capacity of 138 TAF.

Capital ($M): 54.2 (1955 cost-9.19)
Annual ($M): 0.33 (0.6% of capital cost)
Cost/Acre-Foot ($): 393 (based on active storage capacity)

Component-Specific Environmental Evaluation: Not determined.

Issues

Legal and Institutional: Not determined.

Water Source: Little Cow Creek

Site or Route Land Ownership and Use: Not determined.

Socioeconomic: Not determined.

Preliminary Assessment Considerations

CALFED Program Preference by Surface Storage Type: Lowest; new on-stream storage

Potential to Contribute to Increases in Water Supply Opportunities: Low

Potential to Contribute to Operational Flexibility of the State's Water Resources System: Low

The potential yield from this reservoir may be low given the relatively low runoff from the watershed. There is also increasing development within the proposed project area which may preclude the original formulation for this facility.

References: Department of Water Resources, May 1957, *The California Water Plan*, Bulletin No. 3, State of California.

Name of Component: Lake Berryessa Enlargement

Location: Napa County, Putah Creek

Surface Storage Map Location: 4

Type of Storage Facility: Enlargement of an existing on-stream reservoir for off-stream storage.

Component Description: Reservoir capacity would be increased by the construction of a new 645-foot-high Monticello Dam.[1] Water would be diverted from Sacramento River at a point near Sacramento or through the Tehama-Colusa Canal or Glenn-Colusa Canal diversions and conveyed to Lake Berryessa via a new conveyance facility. The reservoir would store excess flows from the Sacramento River or storage transfers from Shasta Lake. Water would be released back to the Sacramento River via a new channel and for use in the Solano Project and the North Bay Aqueduct, offsetting Delta diversions for those projects.

Storage Capacity(ies): 6,000 TAF and 13,000 TAF (includes existing storage of 1,600 TAF).

Constructibility: Seismic activity from four active faults. Filling reservoir increases seismic activity.

Construction Time: 4 years[1]

Cost: Cost estimates have been indexed to January 1996 dollars from costs presented by the Bureau of Reclamation in 1995 for a reservoir with a gross capacity of 13,000 TAF and an increment of new active capacity of 11,200 TAF.

Capital ($M): 2,893[2] (1978 cost-1,447)
Annual ($M): 93.6[2]
Cost/Acre-Foot ($): 258[2] (based on active storage capacity)

Component-Specific Environmental Evaluation: The Department of Fish and Game has concluded that the enlargement of Lake Berryessa would adversely impact wildlife as a result of loss of habitat. Enlargement of this lake would cause the inundation of about 16,000 acres or 44,000 acres for capacities of 6,000 TAF and 13,000 TAF, respectively, and would inundate a proposed refuge area. At the maximum capacity approximately 48,000 acre would be impacted. Increased diversions from the Sacramento River could impact fisheries. The inundation of additonal land and increased diversions from the Sacramento River could potentially impact threatened and endangered species.

Issues

Legal and Institutional: Not deterimined.

Water Source: Lower Sacramento River

Site or Route Land Ownership and Use: Public and private lands

Socioeconomic: Not determined.

Preliminary Assessment Considerations

CALFED Program Preference by Surface Storage Type: Low; enlarge existing on-stream storage

Potential to Contribute to Increases in Water Supply Opportunities: High

Potential to Contribute to Operational Flexibility of the State's Water Resources System: High

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While classified as an on-stream project, the enlargement would facilitate off-stream storage for surplus Sacramento River flows. Previous investigations have referred to Lake Berryessa as one of the most desirable sites available because of the low ratio of embankment volume to storage volumes.

References: [1]Bureau of Reclamation and Fish and Wildlife Service, September 1995, *Least-Cost CVP Yield Increase Plan, Technical Appendix No. 6--Surface Storage and Conveyance*, Department of the Interior.
[2]Anonymous, October 10, 1978 Letter to R.A. Williams.

Name of Component: Chain-of-Lakes Storage and Conveyance Facility

Location: Sacramento-San Joaquin Delta from near Hood to Clifton Court Forebay.

Surface Storage Map Location: 5

Type of Storage Facility: New off-stream storage and conveyance facility.

Component Description: A chain of up to eight contiguous lakes, created from flooded delta islands, would function as an off-stream storage facility and isolated conveyance facility from the Sacramento River to Clifton Court Forebay. Islands would be connected via pumps and siphons constructed beneath Delta channels. Islands likely to be used for storage and/or conveyance includes all or portions of Tyler Island, Staten Island, Bouldin Island, Venice Island, Mandeville Island, Bacon Island, Woodward Island, and Victoria Island.

Storage Capacity(ies): 600 TAF of storage capacity and 15,000 cfs of conveyance capacity.

Constructibility: Six siphons of 18-foot diameter would be required to convey 15,000 cfs between islands. The siphons would be constructed and anchored in soft peat soils that would present a difficulty in supporting construction machinery and anchoring the siphons. There could potentially be up to eight Delta channel crossings. Both the soil type and the high water table in the Delta would create special problems during construction. A pumping plant/diversion with fish screens would be required at the intake from the Sacramento River; additional unscreened pumping plants would likely be required to achieve design flows through the siphons.

Assuming that the levees are of adequate height, the interior faces of the levees would require placement of additional material to armor them against wave wash and provide adequate strength. This would require an estimated 176 million cubic feet of earth and 28 million cubic feet of riprap for the islands identified above. The availability of adequate materials and the placement of that material in soft soils would be problematic.

Construction Time: Not determined.

Cost:

Capital ($M): Not determined.
Annual ($M): Not determined.
Cost/Acre-Foot ($): Not determined.

Component-Specific Environmental Evaluation: This component has the potential to significantly reduce the impacts of current diversion practices in the south Delta by moving the diversion to the lower Sacramento River. However, significant amounts of terrestrial habitat will be inundated as a result of flooding Delta islands for storage. Some habitat, particularly riparian habitat, could be created on the interior embankments of the levees used for storage. Significant environmental disruption could be expected during the construction of the siphons. Development and operation of this project has the potential to affect environmental standards established in the 1994 Bay-Delta Accord and the 1995 SWRCB Water Quality Control Plan.

Issues

Legal and Institutional: Not determined.

Water Source: Lower Sacramento River

Site or Route Land Ownership and Use: Approximately 34,000 acres of agricultural lands would have to be taken out of production and inundated for storage. A majority of the land is in private ownership.

Socioeconomic: Loss of agricultural production.

Preliminary Assessment Considerations

CALFED Program Preference by Surface Storage Type: High, new off-stream reservoir

Potential to Contribute to Increases in Water Supply Opportunities: Moderate

Potential to Contribute to Operational Flexibility of the State's Water Resources System: High

The Chain-of-Lakes facility could reduce the impacts associated with current south-of-Delta diversion activities as well as provide a significant amount of storage within the Delta. A potential drawback would be the retirement of nearly 34,000 acres of agricultural land within a single geographic region.

References: None.

Name of Component: Clair Engle Lake Enlargement

Location: Trinity County, Trinity River

Surface Storage Map Location: 6

Type of Storage Facility: Enlargement of an on-stream reservoir for use as off-stream storage.

Component Description: The enlargement of Clair Engle Lake is an alternative to enlarging Shasta Lake. The enlargement would consist of raising Trinity Dam by about 200 feet. Unregulated flood flows from Sacramento River and excess storage in Shasta Lake would be pumped to Clair Engle Lake through a pump/generation facility. Water would then be released to Shasta Lake to meet water needs during the dry season.

Storage Capacity(ies): Increase reservoir storage by about 4.8 MAF.

Constructibility: The Bureau of Reclamation has experienced landslide problems on the left abutment of the existing Trinity Dam.

Construction Time: Not determined.

Cost: Not determined.

Capital ($M): Not determined.
Annual ($M): Not determined.
Cost/Acre-Foot ($): Not determined.

Component-Specific Environmental Evaluation: Numerous historical sites would be inundated along with a significant coniferous-hardwood forest, meadow, and riparian habitats.

Issues

Legal and Institutional: Not determined.

Water Source: Trinity River and upper Sacramento River

Site or Route Land Ownership and Use: Public lands

Socioeconomic: The communities of Trinity Center, Coffee Creek, and Coveington Mill and numerous resort areas and recreational facilities would need to be relocated. Approximately 20 miles of State Highway 30 would need to be relocated.

Preliminary Assessment Considerations

CALFED Program Preference by Surface Storage Type: Low, enlarge on-stream storage

Potential to Contribute to Increases in Water Supply Opportunities: High

Potential to Contribute to Operational Flexibility of the State's Water Resources System: High

The project would have impacts associated with on-stream development, in particular, potential impacts to fisheries on the Trinity River.

References: Department of Water Resources, October 1994, *California Water Plan Update*, Bulletin No. 160-93, Volume 1, State of California.

Name of Component: Clay Station Reservoir

Location: Sacramento County, Laguna Creek

Surface Storage Map Location: 7

Type of Storage Facility: New off-stream storage

Component Description: The Clay Station Reservoir would store excess flows from the American River and potentially the Sacramento River. Excess American River flows would be diverted at Nimbus Dam and conveyed to Clay Station Reservoir. Excess Sacramento River flows could be stored at Clay Station if a Hood-Clay Station connector conveyance facility is developed. Water storage in Clay Station Reservoir could be used to service areas of Sacramento and San Joaquin Counties.

Storage Capacity(ies): Gross-170 TAF[1]

Constructibility: No significant constructibility issues identified.

Construction Time: 3 years[1]

Cost: Cost estimates have been indexed to January 1996 dollars from costs presented by the Bureau of Reclamation in 1995[1] for a storage reservoir with a gross capacity of 170 TAF.

Capital ($M): 239[1] (1995 cost-230)
Annual ($M): 1.4 (0.6% of capital cost)
Cost/Acre-Foot ($): 1,406 (based on gross storage capacity)

Component-Specific Environmental Evaluation: Loss of 238 acres of wetland, 63 miles of stream; SNA for vernal pools; lone chaparral sensitive plant community; 3 special status plant species.

Issues

Legal and Institutional: Not determined.

Water Source: Clay Station would receive water from the American River via the Folsom South Canal when excess water is available at Folsom Reservoir.

Site or Route Land Ownership and Use: Not determined.

Socioeconomic: Not determined.

Preliminary Assessment Considerations

CALFED Program Preference by Surface Storage Type: High; new off-stream storage

Potential to Contribute to Increases in Water Supply Opportunities: Moderate

Potential to Contribute to Operational Flexibility of the State's Water Resources System: Moderate

Development of this project, which would rely upon utilization of the Folsom South Canal, could interfere with a local project proposed by the East Bay Municipal Utility District and the County of Sacramento.

References: [1]Bureau of Reclamation, *Least-Cost CVP Yield Increase Plan, Technical Appendix No. 6--Surface Storage and Conveyance*, September 1995, Department of the Interior.

[2]Bureau of Reclamation and Fish and Wildlife Service, October 1995, *Least-Cost CVP Yield Increase Plan*, Department of the Interior.

Name of Component: Coloma Reservoir

Location: El Dorado County, South Fork American River

Surface Storage Map Location: 8

Type of Storage Facility: New on-stream storage

Component Description: Coloma Reservoir would store flows on the south fork of the American River.

Storage Capacity(ies): Gross-710 TAF

Constructibility: Not determined.

Construction Time: Not determined.

Cost:

Capital ($M): Not determined.
Annual ($M): Not determined.
Cost/Acre-Foot ($): Not determined.

Component-Specific Environmental Evaluation: Potentially significant impact to aquatic habitat, riparian habitat, and wildlife areas in the inundation area.

Issues

Legal and Institutional: Not determined.

Water Source: South Fork American River

Site or Route Land Ownership and Use: Not determined.

Socioeconomic: Loss of popular white-water recreation area.

Preliminary Assessment Considerations

CALFED Program Preference by Surface Storage Type: Lowest; new on-stream storage

Potential to Contribute to Increases in Water Supply Opportunities: Moderate

Potential to Contribute to Operational Flexibility of the State's Water Resources System: Moderate

This proposed project would have significant socioeconomic impacts resulting from the inundation of the most heavily used whitewater recreation areas in California.

References: Bureau of Reclamation and Fish and Wildlife Service, September 1995, *Least-Cost CVP Yield Increase Plan, Technical Appendix No. 6--Surface Storage and Conveyance*, Department of the Interior.

Name of Component: Colusa Reservoir Complex

Location: Colusa and Glenn Counties, Funks Creek

Surface Storage Map Location: 9

Type of Storage Facility: New off-stream storage

Component Description: Colusa Reservoir Complex is an extension of Sites Reservoir to the north into Glenn County. The Colusa Reservoir would include two large dams where Hunters and Logan Creeks pass through Logan Ridge and of numerous small saddle dams along Logan Ridge. Water would be transported to Colusa Reservoir through the existing Tehama-Colusa and/or Glenn-Colusa Canals or through a new diversion facility from Chico Landing to the Tehama-Colusa Canal. This reservoir would store excess Sacramento River flows for use during drought periods for other needs in the Bay-Delta. See Site Reservoir for additional descriptions.

Storage Capacity(ies): Active-2,900 TAF, gross-3,000 TAF

Constructibility: No significant constructibility issues identified.

Construction Time: Not determined.

Cost: Cost estimates have been indexed to January 1996 dollars from costs presented by DWR in 1996 for a storage reservoir with a gross capacity of 3,000 TAF and an active capacity of 2,900 TAF.

Capital ($M): 1,174 (1995 cost-1,140), does not include pumping facilities, environmental mitigation, Tehama-Colusa Canal upgrade.
Annual ($M): 7.0 (0.6% of capital cost)
Cost/Acre-Foot ($): 405 (based on active storage capacity)

Component-Specific Environmental Evaluation: Probable diversion impacts to Sacramento River winter-run and spring-run salmon. Also see Sites Reservoir attribute matrix.

Issues

Legal and Institutional: No determined.

Water Source: Winter flows from Sacramento River

Site or Route Land Ownership and Use: Combination of public and private lands.

Socioeconomic: Relocation of community of Sites, plus an additional 60 people.

Preliminary Assessment Considerations

CALFED Program Preference by Surface Storage Type: High; new off-stream storage

Potential to Contribute to Increases in Water Supply Opportunities: High

Potential to Contribute to Operational Flexibility of the State's Water Resources System: High

This off-stream storage project could provide long-term storage which would increase the reliability of water supplies during drought conditions.

References: Department of Water Resources, July 1996, *Reconnaissance Survey--Sites Offstream Storage Project*, State of California.

Name of Component: Cooperstown Reservoir

Location: Stanislaus County, Dry Creek

Surface Storage Map Location: 10

Type of Storage Facility: New off-stream storage

Component Description: This reservoir located between the Stanislaus and Tuolumne Rivers would store surplus from both rivers. The reservoir, identified as a component of the East-Side Conveyance Project, would store surplus storage from New Melones and New Don Pedro Reservoirs. In addition, power releases made during non-irrigation periods could be conveyed to Cooperstown Reservoir for storage and later release for irrigation uses.

Storage Capacity(ies): Gross-609 TAF

Constructibility: Not determined.

Construction Time: Not determined.

Cost: Cost estimates have been indexed to January 1996 dollars from costs presented by the Bureau of Reclamation in 1949 for a reservoir with a gross capacity of 609 TAF.

Capital ($M): xxx (1949 cost 15.0)
Annual ($M): (0.6% of capital cost)
Cost/Acre-Foot ($): (gross storage capacity)

Component-Specific Environmental Evaluation: Not determined.

Issues

Legal and Institutional: No determined.

Water Source: Stanislaus and Tuolumne Rivers

Site or Route Land Ownership and Use: Not determined.

Socioeconomic: Not determined

Preliminary Assessment Considerations

CALFED Program Preference by Surface Storage Type: High; off-stream storage

Potential to Contribute to Increases in Water Supply Opportunities: High

Potential to Contribute to Operational Flexibility of the State's Water Resources System: Moderate

References: Bureau of Reclamation, August 1949, *Central Valley Basin - A Comprehensive Department Report on the Development of Water and Related Resources of the Central Valley Basin, and Comments from the State of California and Federal Agencies*, Department of the Interior.

Name of Component: Cottonwood Creek Reservoir Complex

Location: Tehama/Shasta Counties, Cottonwood Creek

Surface Storage Map Location: 11

Type of Storage Facility: New on-stream storage

Component Description: The Cottonwood Creek complex consists of two reservoirs, Dutch Gulch Reservoir on the mainstem of Cottonwood Creek and the Tehama Reservoir on the south fork of Cottonwood Creek. The complex would store runoff from Cottonwood Creek, providing increased water supply opportunities and flood protection on lower Cottonwood Creek. Corps of Engineers studies indicated an average annual yield of 213,000 acre-feet was available during critically dry periods. These reservoirs could also be sized to store excess Sacramento River flows if an appropriate conveyance intertie were constructed. The Corps of Engineers, in 1983, recommended construction of this project as authorized in the Flood Control Act of 1970.

Storage Capacity(ies): Gross-1,600 TAF (Dutch Gulch-900 TAF; Tehama-700 TAF)

Constructibility: No known constructibility issues.

Construction Time: 5 years[1]

Cost: Cost estimates have been indexed to January 1996 dollars from costs presented by the Bureau of Reclamation in 1995 for a reservoir complex with a gross storage capacity of 1,600 TAF.

Capital ($M): 760[1] (1992 cost-685)
Annual ($M): 1.45[3]
Cost/Acre-Foot ($): 475[1] (based on gross storage capacity)

Component-Specific Environmental Evaluation: Inundate 28 miles of stream and riparian habitat supporting small mouth bass, deer, and wild turkey habitat. Historic, archeological, and paleontological sites would also be inundated. Block steel head and salmon from spawning areas[2] and interrupt deer migratory routes. Potential impacts to winter-run salmon due to temperature increases in the Sacramento River.

Issues

Legal and Institutional: Not determined.

Water Source: Cottonwood Creek

Site or Route Land Ownership and Use: Combination of public and private lands

Socioeconomic: Not determined.

Preliminary Assessment Considerations

CALFED Program Preference by Surface Storage Type: Lowest; new on-stream storage

Potential to Contribute to Increases in Water Supply Opportunities: Moderate

Potential to Contribute to Operational Flexibility of the State's Water Resources System: High

References: [1]Bureau of Reclamation and Fish and Wildlife Service, September 1995, *Least-Cost CVP Yield Increase Plan, Technical Appendix No. 6--Surface Storage and Conveyance*, Department of the Interior.
[2]U.S. Army Corps of Engineers, May 1983, General Design Memorandum, Cottonwood Creek.
[3]Department of Water Resources, May 1985, *Cottonwood Creek Alternatives*, State of California.

Name of Component: Deer Creek Meadows Reservoir

Location: Tehama County, Deer Creek

Surface Storage Map Location: 12

Type of Storage Facility: New on-stream storage

Component Description: This reservoir, which would be located in the Sierra Nevada foothills, was originally formulated as a power generation and conservation facility. Flows from Deer Creek could be reregulated for uses in the lower Sacramento River and in the Delta.

Storage Capacity(ies): Active-178 TAF, gross-200 TAF

Constructibility: Not determined.

Construction Time: Not determined.

Cost: Cost estimates have been indexed to January 1996 dollars from costs presented by DWR in 1957 for a reservoir with a gross capacity of 200 TAF and an active capacity of 178 TAF.

Capital ($M): 22.4 (1955 cost-3.8)
Annual ($M): 0.13 (0.6% of capital cost)
Cost/Acre-Foot ($): 126 (based active storage capacity)

Component-Specific Environmental Evaluation: Not determined.

Issues

Legal and Institutional: Not determined.

Water Source: Deer Creek

Site or Route Land Ownership and Use: Not determined.

Socioeconomic: Not determined.

Preliminary Assessment Considerations

CALFED Program Preference by Surface Storage Type: Lowest; new on-stream storage

Potential to Contribute to Increases in Water Supply Opportunities: Low

Potential to Contribute to Operational Flexibility of the State's Water Resources System: Low

References: Department of Water Resources, May 1957, *The California Water Plan*, Bulletin No. 3, State of California.

Name of Component: Deer Creek Reservoir

Location: Sacramento County near Rancho Murietta at Kiefer Boulevard

Surface Storage Map Location: 13

Type of Storage Facility: New off-stream storage

Component Description: Deer Creek would store American River water delivered through the Folsom South Canal. The connecting canal would be 25,000 feet long with a capacity of 5,500 cfs. A pumping plant would be required to lift water from the canal to the reservoir.[1]

Storage Capacity(ies): Gross-600 TAF[1]

Constructibility: Potential flood season exposure while constructing Folsom outlet.[3]

Construction Time: 5 years[2]

Cost: Cost estimates have been indexed to January 1996 dollars from costs, presented by the Bureau of Reclamation in 1995 for a reservoir with a gross capacity of 600 TAF.

Capital ($M): 860[1] (1995 cost-835)
Annual ($M): 5.2 (0.6% of capital cost)
Cost/Acre-Foot ($): 1,433 (based on gross storage capacity)

Component-Specific Environmental Evaluation: Loss of 13,000 acres of habitat, including riparian and wetland; SNA for vernal pools, special status insects, birds, and plants; importation of water from source stream would compete with existing environmental needs of the water.[2]

Issues

Legal and Institutional: Not determined.

Water Source: American River; delivered to Deer Creek via the Folsom South Canal.

Site or Route Land Ownership and Use: Sacramento County Boys Ranch; approximately 15 ranchettes; portion of 115-kV PG&E transmission line; portion of Scotts and Latrobe Roads; and a small portion of the Prairie City State Vehicular Recreation Park.[3]

Socioeconomic: Not determined.

Preliminary Assessment Considerations

CALFED Program Preference by Surface Storage Type: High; new off-stream storage

Potential to Contribute to Increases in Water Supply Opportunities: Moderate

Potential to Contribute to Operational Flexibility of the State's Water Resources System: Low

Development of this project would require the utilization of the Folsom South Canal, which could potentially interfere with local projects proposed by East Bay Municipal Utility District and the County of Sacramento.

References: [1]Bureau of Reclamation and Fish and Wildlife Service, September 1995, *Least-Cost CVP Yield Increase Plan, Technical Appendix No. 6--Surface Storage and Conveyance*, Department of the Interior.

[2]Bureau of Reclamation and Fish and Wildlife Service, October 1995, *Least-Cost CVP Yield Increase Plan*, Department of the Interior.
[3]Earth Science Associates, March 1993, *Pre-Reconnaissance Evaluation of Deer Creek Reservoir.*

Name of Component: In-Delta Storage

Location: Southern Sacramento/San Joaquin Delta

Surface Storage Map Location: 14

Type of Storage Facility: Delta island storage (new off-stream storage)

Component Description: Under the proposed Delta Wetlands Project, Webb Tract and Bacon Island would be used as year-round water supply reservoirs. Bouldin Island and Holland Tract would be dedicated to wetland and wildlife habitat uses. Project would divert and store surplus Delta flows for later release.[1] CALFED will also investigate other configurations of in-Delta storage involving the use of Delta islands in the southern Delta connected to Clifton Court Forebay by siphons.

Storage Capacity(ies): 230 TAF[1]

Constructibility: Possible subsidence of reservoirs due to loading and possible liquefaction of Delta silts due to seismic activity.[1]

Construction Time: One year[1]

Cost: Price of the project would be influenced by when and how water from the project could be used. Other important factors include how the Bay-Delta Standards are applied, regulatory requirements of the fisheries agencies, and the terms and conditions the SWRCB would attach to the Delta wetlands water rights permits.

Capital ($M): Not determined.
Annual ($M): Not determined.
Cost/Acre-Foot ($): Not determined.

Component-Specific Environmental Evaluation: Reduced water quality and reversed flows; fish migration impacts; increased predation, entrainment, and water temperature; adverse effect to listed fish species; could substantially impact the environmental standards established in the 1994 Bay-Delta Accord and the 1995 SWRCB Water Quality Control Plan.

Issues

Legal and Institutional: Not determined.

Water Source: Sacramento-San Joaquin Delta

Site or Route Land Ownership and Use: Not determined.

Socioeconomic: Not determined.

Preliminary Assessment Considerations

CALFED Program Preference by Surface Storage Type: High; new off-stream storage

Potential to Contribute to Increases in Water Supply Opportunities: Moderate

Potential to Contribute to Operational Flexibility of the State's Water Resources System: High

With the appropriate storage capacity, an in-Delta storage project could provide a significant amount of flexibility for releases for either environmental or water supply uses.

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References: [1]Bureau of Reclamation and Fish and Wildlife Service, September 1995, *Least-Cost CVP Yield Increase Plan, Technical Appendix No. 6--Surface Storage and Conveyance*, Department of the Interior.
[2]Bureau of Reclamation and Fish and Wildlife Service, October 1995, *Least-Cost CVP Yield Increase Plan*, Department of the Interior.

Name of Component: Duck Creek Reservoir

Location: San Joaquin County, Duck Creek

Surface Storage Map Location: 15

Type of Storage Facility: New off-stream storage

Component Description: Flows from the Mokelumne River and excess storage in Pardee Reservoir would be diverted for storage in Duck Creek Reservoir.[1]

Storage Capacity(ies): Gross-100 TAF[1]; gross-100 to 200[3]

Constructibility: No significant constructibility issues identified.

Construction Time: 2.5 years[3]

Cost: Cost estimates have been indexed to January 1996 dollars from costs presented by the Bureau of Reclamation in 1995 for a reservoir with a gross storage capacity of 100 TAF.

Capital ($M): 236[1] (1955 cost-229)
Annual ($M): 1.4[1] (0.6% of capital cost)
Cost/Acre-Foot ($): 2,360[1] (based on gross storage capacity)

Expected Service Life: 100 years

Component-Specific Environmental Evaluation: Loss of grassland and riparian habitat; importation of water from source stream would compete with existing environmental needs of the water.

Issues

Legal and Institutional: Not determined.

Water Source: Mokelumne River surplus from Pardee Reservoir

Site or Route Land Ownership and Use: Range land. Property consists of large parcels under seven or eight different ownerships.

Socioeconomic: Not determined.

Preliminary Assessment Considerations

CALFED Program Preference by Surface Storage Type: High; new off-stream storage

Potential to Contribute to Increases in Water Supply Opportunities: Moderate

Potential to Contribute to Operational Flexibility of the State's Water Resources System: Moderate

References:
[1]Bureau of Reclamation and Fish and Wildlife Service, September 1995, *Least-Cost CVP Yield Increase Plan, Technical Appendix No. 6--Surface Storage and Conveyance*, Department of the Interior.
[2]Bureau of Reclamation and Fish and Wildlife Service, October 1995, *Least-Cost CVP Yield Increase Plan*, Department of the Interior.
[3]James C. Hanson Consulting Civil Engineer, February 1993, *San Joaquin County, Proposed Duck Creek Project, Reconnaissance-Level Design Study and Cost Estimate.*

Name of Component: Farmington Reservoir Enlargement

Location: San Joaquin County, Littlejohns Creek

Surface Storage Map Location: 16

Type of Storage Facility: Enlargement of an on-stream reservoir for use as an off-stream reservoir

Component Description: Reservoir capacity would be increased by raising the dam height by 16 feet. Water would be released into Littlejohns Creek, which eventually releases into the San Joaquin River. Water to fill the increased storage capacity is assumed to be flood flows diverted from the Stanislaus River into the existing Upper Farmington Canal (Q = 500 cfs).

Storage Capacity(ies): 160 TAF (includes 52 TAF flood and 8 TAF additional sediment).

Constructibility: No significant constructibility issues are known to exist.

Construction Time: Because of the minor increase in dam height, the required construction time is expected to be minimal.

Cost: Cost estimates have been indexed to January 1996 dollars from costs presented by the Army Corps of Engineers in January 1981.

Capital ($M): 53.6 (1981 cost-$42)
Annual ($M): 0.3 (0.6% of capital cost)
Cost/Acre-Foot ($): 536 (based on active storage capacity)

Component-Specific Environmental Evaluation: Loss of scarce riparian habitat and swallow nesting habitat.

Issues

Legal and Institutional: Not determined.

Water Source: Stanislaus River and local creeks

Site or Route Land Ownership and Use: Not determined.

Socioeconomic: Not determined.

Preliminary Assessment Considerations

CALFED Program Preference by Surface Storage Type: Low; enlarge on-stream storage

Potential to Contribute to Increases in Water Supply Opportunities: Low

Potential to Contribute to Operational Flexibility of the State's Water Resources System: Low

As a new on-stream facility, it would be assumed to have impacts associated with an on-stream reservoir and would, therefore, have the least desirability among the surface storage options being considered by CALFED.

References: [1]Bureau of Reclamation and Fish and Wildlife Service, September 1995, *Least-Cost CVP Yield Increase Plan, Technical Appendix No. 6--Surface Storage and Conveyance*, Department of the Interior.

Name of Component: Fiddlers Reservoir

Location: Tehama and Shasta Counties, middle fork of Cottonwood Creek

Surface Storage Map Location: 17

Type of Storage Facility: New on-stream storage

Component Description: Fiddlers Reservoir has been suggested as an alternative to the Cottonwood Creek Complex (Dutch Gulch and Tehama Reservoirs). Fiddlers Reservoir was considered by the DWR[1] in conjunction with two other reservoirs--Hulen and Dippingvat Reservoirs. These reservoirs would provide flood protection and conservation storage for Cottonwood Creek flows. However, the Cottonwood Creek Complex offers greater amounts of flood protection and conservation storage.

Storage Capacity(ies): Active-388 TAF, gross-545 TAF[1]; active-270 TAF, gross-310 TAF[2]

Constructibility: No significant constructibility issues have been identified.

Construction Time: 3 years[1]

Cost: Cost estimates have been indexed to January 1996 dollars from costs presented by DWR in 1985 for a reservoir with a gross storage capacity of 545 TAF and an active storage capacity of 388 TAF.

Capital ($M): 227[1] (1985 cost-173.4)
Annual ($M): 0.92[1]
Cost/Acre-Foot ($): 585[1] (based on active storage capacity)

Expected Service Life: 100 years

Component-Specific Environmental Evaluation: Not determined.

Issues

Legal and Institutional: Not determined.

Water Source: Middle fork of Cottonwood Creek

Site or Route Land Ownership and Use: Not determined.

Socioeconomic: Not determined.

Preliminary Assessment Considerations

CALFED Program Preference by Surface Storage Type: Lowest; new on-stream storage

Potential to Contribute to Increases in Water Supply Opportunities: Low

Potential to Contribute to Operational Flexibility of the State's Water Resources System: Low

Fiddlers Reservoir, by itself or in conjunction with Hulen and Dippingvat Reservoirs, could not provide the same level of benefits as either the Cottonwood Creek Complex or the Red Bank Project.

References: [1]Department of Water Resources, May 1985, *Cottonwood Creek Alternative*, State of California.

[2]Department of Water Resources, May 1957, *The California Water Plan*, Bulletin No. 3, State of California.

Name of Component: Folsom Reservoir

Location: El Dorado, Placer, and Sacramento Counties, American River

Surface Storage Map Location: 18

Type of Storage Facility: Enlargement of an existing on-stream storage reservoir

Component Description: Folsom Dam would be raised by 30 feet. Additional wing dam and dike height and length would also be required.[1] Surplus American River flows would be retained by the enlarged dam(s). Additional storage would be regulated for uses in the Delta.

Storage Capacity(ies): Gross-1,340 TAF[1] (includes existing capacity of 974 TAF)

Constructibility: No significant constructibility issues identified other than seismic risk.

Construction Time: 3 years[1,2]

Cost: Cost estimates have been indexed to January 1996 dollars from costs presented by the Bureau of Reclamation in 1995 for an increment of new storage capacity of 1,340 TAF.

Capital ($M): 489[1] (1995 cost-475)
Annual ($M): 2.9 (0.6% of capital cost)
Cost/Acre-Foot ($): Enlargement cost/enlarged gross reservoir capacity = 1,336

Expected Service Life: 100 years

Component-Specific Environmental Evaluation: Loss of up to 1,952 acres of upland and 3.4 miles of stream habitat; 3,740 acres required to mitigate; two SNAs for several special status plant species.[2]

Issues

Legal and Institutional: Not determined.

Water Source: American River

Site or Route Land Ownership and Use: Public lands

Socioeconomic: Not determined.

Preliminary Assessment Considerations

CALFED Program Preference by Surface Storage Type: Low; enlarge on-stream storage

Potential to Contribute to Increases in Water Supply Opportunities: High

Potential to Contribute to Operational Flexibility of the State's Water Resources System: High

The enlargement of this reservoir, which is located within a populated area, may require resolution of significant legal, institutional, and socioeconomic issues.

References: [1]Bureau of Reclamation and Fish and Wildlife Service, September 1995, *Least-Cost CVP Yield Increase Plan, Technical Appendix No. 6--Surface Storage and Conveyance*, Department of the Interior.

[2]Bureau of Reclamation and Fish and Wildlife Service, October 1995, *Least-Cost CVP Yield Increase Plan*, Department of the Interior.

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Name of Component: Freemans Crossing Reservoir

Location: Yuba/Nevada Counties, Middle Yuba River

Surface Storage Map Location: 19

Type of Storage Facility: New on-stream storage

Component Description: This new on-stream reservoir would store flows on the middle fork of the Yuba River. Stored water would be used for power production and regulated for consumptive and environmental uses.

Storage Capacity(ies): Active-295 TAF, gross-300 TAF

Constructibility: Not determined.

Construction Time: Not determined.

Cost: Cost estimates have been indexed to January 1996 dollars from costs presented by DWR in 1957 for a reservoir with a gross storage capacity of 300 TAF and an active storage capacity of 295 TAF.

Capital ($M): 225.5 (1955 cost-38.22)
Annual ($M): 1.4 (0.6% of capital cost)
Cost/Acre-Foot ($): 764 (based on active storage capacity)

Component-Specific Environmental Evaluation: Not determined.

Issues

Legal and Institutional: Not determined.

Water Source: Yuba River

Site or Route Land Ownership and Use: Not determined.

Socioeconomic: Not determined.

Preliminary Assessment Considerations

CALFED Program Preference by Surface Storage Type: Lowest; new on-stream storage

Potential to Contribute to Increases in Water Supply Opportunities: High

Potential to Contribute to Operational Flexibility of the State's Water Resources System: Moderate

The U.S. Fish and Wildlife Service has considered this area for designation as Wild and Scenic.

References: Department of Water Resources, May 1957, *The California Water Plan*, Bulletin No. 3, State of California.

Name of Component: Gallatin Reservoir

Location: Tehama County, Elder Creek approximately 18 miles southwest of Red Bluff

Surface Storage Map Location: 20

Type of Storage Facility: New on-stream storage

Component Description: Elder Creek has a mean annual runoff of 55 TAF. Gallatin Reservoir would provide conservation storage, hydroelectric capacity, and some flood control storage.

Storage Capacity(ies): Gross-370 TAF[1]; active-176 TAF, gross-183 TAF[2]

Constructibility: Not determined.

Construction Time: Not determined.

Cost: Cost estimates have been indexed to January 1996 dollars from costs presented by the DWR in 1957 for a reservoir with a gross storage capacity of 183 TAF and an active storage capacity of 176 TAF.

Capital ($M): 27.7[2] (1955 cost-4.7)
Annual ($M): 0.2 (0.6% of capital cost)
Cost/Acre-Foot ($): 157 (based on active storage capacity)

Component-Specific Environmental Evaluation: Not determined.

Issues

Legal and Institutional: Not determined.

Water Source: Elder Creek

Site or Route Land Ownership and Use: Not determined.

Socioeconomic: Not determined.

Preliminary Assessment Considerations

CALFED Program Preference by Surface Storage Type: Lowest; new on-stream storage

Potential to Contribute to Increases in Water Supply Opportunities: Low

Potential to Contribute to Operational Flexibility of the State's Water Resources System: Low

References:

[1]Anonymous, August 1982, *Enlarging Shasta Lake Feasibility Study, Description of Alternative Storage.*
[2]Department of Water Resources, May 1957, *The California Water Plan*, Bulletin No. 3, State of California.
[3]Department of Water Resources, February 1975, *Major Surface Water Development Opportunities in the Sacramento Valley*, State of California--Northern District.

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Name of Component: Garden Bar Reservoir

Location: Sutter County, Bear River

Surface Storage Map Location: 21

Type of Storage Facility: New on-stream storage

Component Description: Provides new water supply and power capabilities and could be operated in conjunction with Camp Far West. The project could also be coordinated with DWR's Oroville operation.[4]

Storage Capacity(ies): Gross-245 TAF[1]

Constructibility: No significant constructibility issues identified.

Construction Time: 5 years[1]; 3.5 years[2]

Cost: Cost estimates have been indexed to January 1996 dollars from costs presented by the Bureau of Reclamation in 1995 for a reservoir with a gross storage capacity of 245 TAF.

Capital ($M): 196[1] (1989 cost-161)
Annual ($M): 1.2 (0.6% of capital cost)
Cost/Acre-Foot ($): 800 (based on gross storage capacity)

Component-Specific Environmental Evaluation: Loss of 2,000 acres, including riparian and wetlands; impacts to anadromous fish and deerwinter habitat; conversion of land from agricultural land use; enlarged reservoir area of little value as fishery or to wildlife.

Issues

Legal and Institutional: Not determined.

Water Source: Bear River

Site or Route Land Ownership and Use: Not determined.

Socioeconomic: Not determined.

Preliminary Assessment Considerations

CALFED Program Preference by Surface Storage Type: Lowest; new on-stream storage

Potential to Contribute to Increases in Water Supply Opportunities: Moderate

Potential to Contribute to Operational Flexibility of the State's Water Resources System: Moderate

References:
[1]Bureau of Reclamation and Fish and Wildlife Service, September 1995, *Least-Cost CVP Yield Increase Plan, Technical Appendix No. 6--Surface Storage and Conveyance*, Department of the Interior.
[2]South Sutter Water District, November 1985, *Garden Bar Dam and Reservoir, Water Power Project.*
[3]Bureau of Reclamation and Fish and Wildlife Service, October 1995, *Least-Cost CVP Yield Increase Plan*, Department of the Interior.
[4]South Sutter Water District, August 1984, *Garden Bar Dam and Reservoir.*

Name of Component: Garzas Reservoir

Location: Stanislaus County, Garzas Creek

Surface Storage Map Location: 22

Type of Storage Facility: New off-stream storage

Component Description: Garzas Reservoir would increase firm yield and the average annual water delivery capability of the SWP and CVP. The reservoir would be filled with Delta pumping of spring and winter excess flows. There are two alternative dam sites. The upper dam site is about 3 miles from California Aqueduct. It has higher water storage to embankment ratios and requires two pumping plants and 80 feet additional lift. The lower dam site is 2.25 miles west of the aqueduct and requires one pumping plant.[1]

Storage Capacity(ies): Active-139 to 1,754 TAF[2]

Constructibility: No significant constructibility issues identified.

Construction Time: Not determined.

Cost: Cost estimates have been indexed to January 1996 dollars from costs presented by DWR in 1996 for a reservoir with an active capacity of 139 to 1,754 TAF.

Capital ($M): 361-2,295[2] (1996 cost)
Annual ($M): 2.2-13.8 (0.6% of capital cost)
Cost/Acre-Foot ($): 2,597-1,308[2] (active storage capacity)

Component-Specific Environmental Evaluation: Inundate 15 miles of Garzas Creek, 2,600 acres of wildlife habitat. Sensitive species such as Greene's orcutt grass, San Joaquin Valley orcutt grass, Colusa grass, giant Garter snake, and San Joaquin kit fox may occur.[1] Potential for archaeological to exist in the area.

Issues

Legal and Institutional: Not determined.

Water Source: Sacramento-San Joaquin Delta via the California Aqueduct or Delta-Mendota Canal.

Site or Route Land Ownership and Use: Combination of public and private lands

Socioeconomic: Not determined.

Preliminary Assessment Considerations

CALFED Program Preference by Surface Storage Type: High; new off-stream storage

Potential to Contribute to Increases in Water Supply Opportunities: High

Potential to Contribute to Operational Flexibility of the State's Water Resources System: High

References: [1]Department of Water Resources, May 1984, *Alternative Plans for Offstream Storage South of the Delta*, State of California.
[2]Department of Water Resources, August 1996, *Alternatives South of the Delta, Offstream Reservoir Study*, State of California.

Name of Component: Glenn Reservoir

Location: Glenn and Tehama Counties, Stony Creek

Surface Storage Map Location: 23

Type of Storage Facility: New off-stream storage

Component Description: Glenn Reservoir is a combination of Newville Reservoir on the North Fork of Stony Creek and Rancheria Reservoir, which would be formed by damming the main stem of Stony Creek. Water would be pumped from the Sacramento River to support the large-scale reservoir.

Storage Capacity(ies): Gross-8,206 TAF[2] (built as an expansion of Thomes-Newville Reservoir)

Constructibility: No significant constructibility issues identified.

Construction Time: 6 years (Rancheria Dam)

Cost: Cost estimates have been indexed to January 1996 dollars from costs presented by DWR in 1980 for a reservoir with a gross storage capacity of 8,206 TAF.

Capital ($M): 3,438[2] (1980 cost-2,130)
Annual ($M): 20.6
Cost/Acre-Foot ($): 419 (based on gross storage capacity)

Expected Service Life: 100 years

Component-Specific Environmental Evaluation: Inundate several miles of intermittent stream habitat; eliminate part of a periodic salmon run; fish losses at Sacramento River diversion; inundate 53,400 acres of primarily grassland habitat; displace over 600 migratory and resident deer. Inundate vernal pools, an estimated 223 prehistoric, 35 ethnographic and 70 significant historic sites in project area.[1]

Issues

Legal and Institutional: Not determined.

Water Source: Local runoff and surplus Sacramento River

Site or Route Land Ownership and Use: Not determined.

Socioeconomic: Not determined.

Preliminary Assessment Considerations

CALFED Program Preference by Surface Storage Type: High; new off-stream storage

Potential to Contribute to Increases in Water Supply Opportunities: High

Potential to Contribute to Operational Flexibility of the State's Water Resources System: High

References: [1]Department of Water Resources, September 1988, *Enlarged Shasta Wrap Up Report*, State of California.
[2]Department of Water Resources, November 1980, *Thomes-Newville and Glenn Reservoir Plans*, State of California.

Name of Component: Hulen Reservoir

Location: Shasta County, North Fork of Cottonwood Creek

Surface Storage Map Location: 24

Type of Storage Facility: New on-stream storage

Component Description: Hulen Reservoir has been considered as an alternative, along with Fiddlers and Dippingvat Reservoirs, to the Cottonwood Creek Complex (Dutch Gulch and Tehama Reservoirs). Hulen Reservoir would store flows from the north fork of Cottonwood Creek.

Storage Capacity(ies): Active-180 TAF, gross-244 TAF[1]; Active-93.4 TAF, gross-96.4 TAF[2]

Constructibility: No significant constructibility issues identified.

Construction Time: 3 years

Cost: Cost estimates have been indexed to January 1996 dollars from costs presented by the DWR in 1985 for a reservoir with a gross capacity of 244 TAF and an active capacity of 180 TAF.

Capital ($M): 92.4[1] (1985 cost-70.5)
Annual ($M): 0.39[1]
Cost/Acre-Foot ($): 513[1] (based on active storage capacity)

Expected Service Life: 100 years

Component-Specific Environmental Evaluation: Inundate one of the most significant lower cretaceous paleontological sites in North America.

Issues

Legal and Institutional: Not determined.

Water Source: North fork of Cottonwood Creek

Site or Route Land Ownership and Use: Not determined.

Socioeconomic: Not determined.

Preliminary Assessment Considerations

CALFED Program Preference by Surface Storage Type: Lowest; new on-stream storage

Potential to Contribute to Increases in Water Supply Opportunities: Low

Potential to Contribute to Operational Flexibility of the State's Water Resources System: Low

References: [1]Department of Water Resources, May 1985, *Cottonwood Creek Alternatives*, State of California.
[2]Department of Water Resources, May 1957, *The California Water Plan*, Bulletin No. 3, State of California.

Name of Component: Ingram Canyon Reservoir

Location: Stanislaus County, Ingram Creek

Surface Storage Map Location: 25

Type of Storage Facility: New off-stream storage

Component Description: The Ingram Canyon Reservoir would provide off-stream storage for excess Delta flows pumped at Banks Pumping Plant and conveyed through the California Aqueduct. The additional off-stream storage south of the Delta would increase water supply reliability of the SWP and CVP.

Storage Capacity(ies): Active-333 to 1,201 TAF

Constructibility: Not determined.

Construction Time: Not determined.

Cost: Cost estimates have been indexed to January 1996 dollars from costs presented by the DWR in 1996 for a reservoir with an active storage capacity of 333 to 1,201 TAF.

Capital ($M): 711-2,697 (1996 cost)
Annual ($M): 4.3-16.2 (0.6% of capital cost)
Cost/Acre-Foot ($): 2,135-2,245 (based on active storage capacity)

Component-Specific Environmental Evaluation: Not determined.

Issues

Legal and Institutional: Not determined.

Water Source: Sacramento-San Joaquin Delta via the California Aqueduct or Delta-Mendota Canal

Site or Route Land Ownership and Use: Not determined.

Socioeconomic: Not determined.

Preliminary Assessment Considerations

CALFED Program Preference by Surface Storage Type: High; new off-stream storage

Potential to Contribute to Increases in Water Supply Opportunities: High

Potential to Contribute to Operational Flexibility of the State's Water Resources System: High

References: Department of Water Resources, August 1996, *Alternatives South of the Delta, Offstream Reservoir Study*, State of California.

Name of Component: Kettleman Plain Reservoir

Location: Kings County, west of the California Aqueduct and north of the Coastal Branch facility.

Surface Storage Map Location: 26

Type of Storage Facility: New off-stream storage

Component Description: This reservoir would be connected to the California Aqueduct and possibly to the Coastal Branch Aqueduct. Excess Delta flows would be pumped into the reservoir through the California Aqueduct. The additional south-of-Delta storage would increase the water supply reliability of the CVP and SWP.

Storage Capacity(ies): Active-133 to 283 TAF

Constructibility: Not determined.

Construction Time: Not determined.

Cost: Cost estimates have been indexed to January 1996 dollars from costs presented by the DWR in 1996 for a reservoir with an active storage capacity of 133 to 283 TAF.

Capital ($M): 320-423 (1996 cost)
Annual ($M): 1.9-2.5 (0.6% of capital cost)
Cost/Acre-Foot ($): 2,406-1,495 (based on active storage capacity)

Component-Specific Environmental Evaluation: Not determined.

Issues

Legal and Institutional: Not determined.

Water Source: Sacramento-San Joaquin Delta via the California Aqueduct or the Delta-Mendota Canal

Site or Route Land Ownership and Use: Not determined.

Socioeconomic: Not determined.

Preliminary Assessment Considerations

CALFED Program Preference by Surface Storage Type: High; new off-stream storage

Potential to Contribute to Increases in Water Supply Opportunities: High

Potential to Contribute to Operational Flexibility of the State's Water Resources System: High

References: Department of Water Resources, August 1996, *Alternatives South of the Delta, Offstream Reservoir Study*, State of California.

Name of Component: Kosk Reservoir

Location: Shasta County, Pit River approximately two miles downstream from the community of Big Bend

Surface Storage Map Location: 27

Type of Storage Facility: New on-stream storage

Component Description: Kosk Reservoir would be a multipurpose water storage facility located upstream from Lake Shasta on the Pit River. Conservation storage from this reservoir would be used to optimize power production downstream while meeting the demands of the SWP and CVP.

Storage Capacity(ies): Gross-800 TAF[1,2]

Constructibility: Not determined.

Construction Time: Not determined.

Cost:

Capital ($M): Not determined.
Annual ($M): Not determined.
Cost/Acre-Foot ($): Not determined.

Component-Specific Environmental Evaluation: 5 prehistoric, 8 ethnographic and 19 historic sites exist in project area. Inundate 12 miles of intermittent stream habitat, 4,750 acres of primarily coniferous-hardwood forest, chaparral and riparian habitat. Eliminate black-tailed deer, elk, black bear and upland game species.[1] Probable elimination of Shasta slender salamander and its habitat.

Issues

Legal and Institutional: Not determined.

Water Source: Pit River

Site or Route Land Ownership and Use: Not determined.

Socioeconomic: The community of Big Bend and several miles of U.S. Forest Service and county roads in the reservoir area would require relocation.[2]

Preliminary Assessment Considerations

CALFED Program Preference by Surface Storage Type: Low; new on-stream storage

Potential to Contribute to Increases in Water Supply Opportunities: Low

Potential to Contribute to Operational Flexibility of the State's Water Resources System: Low

References: [1]Department of Water Resources, September 1988, *Enlarged Shasta Wrap Up Report*, State of California.
[2]Anonymous, August 1982, *Enlarging Shasta Lake Feasibility Study, Description of Alternative Storage Facility.*

Name of Component: Little Salado-Crow Reservoir

Location: Stanislaus County, Crow Creek. Lies 1 mile west of California Aqueduct and 45 miles south of Clifton Court Forebay.

Surface Storage Map Location: 28

Type of Storage Facility: New off-stream storage

Component Description: This reservoir would be connected to the California Aqueduct so that excess Delta flows could be pumped from the Delta and stored. The additional off-stream storage south of the Delta would increase water supply reliability of the SWP and CVP. Reservoir would have high surface area to storage volume ratios; therefore, there would be high land acquisition costs and high evaporation loss.[1]

Storage Capacity(ies): Active-132 to 250 TAF[2]

Constructibility: Requires relocating 7 miles of PG&E high voltage transmission lines (2-500 kV and 2-230 kV).[1]

Construction Time: Not determined.

Cost: Cost estimates have been indexed to January 1996 dollars from costs presented by the DWR in 1996 for a reservoir with an active storage capacity of 132 to 250 TAF.

Capital ($M): 305-871[2] (1996 cost)
Annual ($M): 1.8-5.2 (0.6% of capital cost)
Cost/Acre-Foot ($): 2,301-3,484[2] (based on active storage capacity)

Component-Specific Environmental Evaluation: Inundate 4 buildings, 1 mile of Salado Creek, 3 miles of Crow Creek, and 2,180 acres of existing wildlife habitat. Possible that sensitive species exist. One known cultural site exists in project area.[1]

Issues

Legal and Institutional: Not determined.

Water Source: Sacramento-San Joaquin Delta via the California Aqueduct or the Delta-Mendota Canal

Site or Route Land Ownership and Use: Combination of public and private lands.

Socioeconomic: Not determined.

Preliminary Assessment Considerations

CALFED Program Preference by Surface Storage Type: High; new off-stream storage

Potential to Contribute to Increases in Water Supply Opportunities: High

Potential to Contribute to Operational Flexibility of the State's Water Resources System: High

References: [1]Department of Water Resources, May 1984, *Alternative Plans for Offstream Storage South of the Delta*, State of California.
[2]Department of Water Resources, August 1996, *Alternatives South of the Delta, Offstream Reservoir Study*, State of California.

Name of Component: Los Banos Grandes Reservoir

Location: Merced County, Los Banos Creek

Surface Storage Map Location: 29

Type of Storage Facility: New off-stream storage

Component Description: This reservoir, which is adjacent to San Luis Reservoir, would be connected with the California Aqueduct so that excess Delta flows could be conveyed to and stored within the reservoir. Additional off-stream storage in association with the California Aqueduct would increase the water supply reliability of the SWP and CVP. Factors limiting the size of this reservoir are the locations of saddle dams and an earthquake fault. The main dam would be constructed on Los Banos Creek, approximately 6 miles south of San Luis Dam and 6 miles west of California Aqueduct.

Storage Capacity(ies): Active-276 to 2,000 TAF[2]

Constructibility: Earthquake fault at the northwest end of reservoir inundation area. A 500-kV transmission line would need to be relocated if the reservoir elevation exceeds 610 feet.

Construction Time: 7 years[3]

Cost: Cost estimates have been indexed to January 1996 dollars from costs presented by the DWR in 1996 for a reservoir with an active storage capacity of 276 to 2,000 TAF.

Capital ($M): 378-1,098[2] (1996 cost)
Annual ($M): 2.3-6.6 (0.6% of capital cost)
Cost/Acre-Foot ($): 1,369-549[2] (based on active storage capacity)

Component-Specific Environmental Evaluation: Loss of 7 to 10 miles of mature riparian vegetation along Los Banos Creek. Loss of sycamores. Habitat would be lost for 3 federally listed threatened and endangered species . Additional sensitive species might exist. Loss of intermittent streamflow would affect breeding and terrestrial habitat of some wildlife species. Eleven archeological sites have been recorded in the area and 24 others within a 2-mile radius. Reservoir area contains 7 ranches and less than 50 people and would inundate 12,800 acres.[3]

Issues

Legal and Institutional: Not determined.

Water Source: Los Banos Creek and Sacramento-San Joaquin Delta water conveyed through the California Aqueduct or the Delta-Mendota Canal.

Site or Route Land Ownership and Use: Combination of public and private lands including seven ranches.

Socioeconomic: Not determined.

Preliminary Assessment Considerations

CALFED Program Preference by Surface Storage Type: High; new off-stream storage

Potential to Contribute to Increases in Water Supply Opportunities: High

Potential to Contribute to Operational Flexibility of the State's Water Resources System: High

References: [1]Department of Water Resources, May 1984, *Alternative Plans for Offstream Storage South of the Delta*, State of California.
[2]Department of Water Resources, August 1996, *Alternatives South of the Delta, Offstream Reservoir Study*, State of California.
[3]Department of Water Resources, August 1991, *Los Banos Grandes Facilities*, State of California.

Name of Component: Los Vaqueros Reservoir

Location: Contra Costa County, Kellogg Creek

Surface Storage Map Location: 30

Type of Storage Facility: Enlargement of off-stream storage

Component Description: The Los Vaqueros Reservoir is currently being constructed by Contra Costa Water District for water quality and emergency storage purposes. An enlarged reservoir would store excess Delta flow diverted through a new connection with Clifton Court Forebay or through the diversion currently being constructed on Old River. The stored water would be released for needs in the California Aqueduct and to offset Delta diversions during environmentally critical periods. This off-stream storage facility would increase water supply reliability of the SWP and CVP. For the present purposes a capacity of 300 TAF was selected, however, the DWR has investigated a 1,065 TAF reservoir in this location.[2] As CALFED's evaluation of potential storage facilities progresses this facility may be evaluated at the larger capacity.

Storage Capacity(ies): Gross capacity of the existing reservoir will be 100 TAF when complete. The enlarged gross capacity would be 300 TAF (additional 200 TAF).

Constructibility: No known significant constructibility issues.

Construction Time: Not determined.

Cost:

Capital ($M): Not determined.
Annual ($M): Not determined.
Cost/Acre-Foot ($): Not determined.

Component-Specific Environmental Evaluation: Loss of riparian habitat along Kellogg Creek. San Joaquin kit fox, Alameda striped racer, golden eagle, and prairie falcon have been identified at or near the reservoir site. Two federally listed endangered plant species, Mount Diablo manzanita and Mount Diablo rock rose exist near the site.

Issues

Legal and Institutional: Not determined.

Water Source: Sacramento-San Joaquin Delta

Site or Route Land Ownership and Use: Not determined.

Socioeconomic: Not determined.

Preliminary Assessment Considerations

CALFED Program Preference by Surface Storage Type: Highest; enlarge off-stream storage

Potential to Contribute to Increases in Water Supply Opportunities: Moderate

Potential to Contribute to Operational Flexibility of the State's Water Resources System: Moderate

References: [1] Contra Costa Water District, September 1993, *Los Vaqueros Final Environmental Impact Report.*
[2] Department of Water Resources, April 1983, *Los Vaqueros Offstream Storage Unit Studies: Wrap-Up Report*, State of California - Central District.

Name of Component: Marysville Reservoir

Location: Yuba County, Yuba River

Surface Storage Map Location: 31

Type of Storage Facility: New on-stream storage

Component Description: This reservoir located on the mainstem of the Yuba River would regulate runoff from the Yuba River. Releases could be made for uses in the Delta. The main dam is located at Parks Bar on the Yuba River. Another dam would be located on Dry Creek. Storage capacity of Englebright Reservoir would be a part of Marysville Reservoir storage capacity.[1]

Storage Capacity(ies): Gross-1,050 TAF[1] (includes Englebright); active-896 TAF, gross-916 TAF[3]

Constructibility: No significant constructibility issues identified other than seismic risks.

Construction Time: 9 years[1]; 4 years[3]

Cost: Cost estimates have been indexed to January 1996 dollars from costs presented by Bookman-Edmonston Engineering, Inc. in 1981 for a reservoir with a gross storage capacity of 916 TAF and an active storage capacity of 896 TAF.

Capital ($M): 1,073[3] (1981 cost-740)
Annual ($M): 3.9[4]
Cost/Acre-Foot ($): 1,198[3] (based on active storage capacity)

Component-Specific Environmental Evaluation: 321 prehistoric, 17 ethnographic, and 246 historic sites exist in project area. Inundate 47 miles of stream habitat. Eliminate 24,000 salmon and 200 steelhead in Yuba River. Inundate 8,100 acres of oak, savannah, grassland, agricultural and meadow habitat. Eliminate 600 to 2,400 deer.[2]

Issues

Legal and Institutional: Not determined.

Water Source: Yuba River

Site or Route Land Ownership and Use: Principally rural with dry rangeland for cattle. Smaller acreages of irrigated pasture exist. Project area also contains UC Sierra Foothill Range Field Station.

Socioeconomic: About 130 dwelling units scattered throughout project area. Loss of irrigated pasture and rangeland for cattle.

Preliminary Assessment Considerations

CALFED Program Preference by Surface Storage Type: Lowest; new on-stream storage

Potential to Contribute to Increases in Water Supply Opportunities: High

Potential to Contribute to Operational Flexibility of the State's Water Resources System: High

References: [1]Bureau of Reclamation and Fish and Wildlife Service, September 1995, *Least-Cost CVP Yield Increase Plan, Technical Appendix No. 6--Surface Storage and Conveyance*, Department of the Interior.
[2]Department of Water Resources, September 1988, *Enlarged Shasta Wrap Up Report*, State of California.

[3]Bookman-Edmonston Engineering, Inc., July 1981, *Findings and Conclusions on Preliminary Evaluation of Marysville, Reservoir.*
[4]Department of Water Resources, October 1985, *Preliminary Findings Report Marysville Reservoir*, State of California.

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Name of Component: Millerton Lake Enlargement

Location: Fresno County, San Joaquin River

Surface Storage Map Location: 32

Type of Storage Facility: Enlargement of existing on-stream storage

Component Description: The expansion of Millerton Lake to a total capacity of 1,400 TAF would allow a greater portion of the 1,700 TAF average annual runoff to be captured and re-regulated. This reservoir would provide additional yields to the Friant Canal Project and for uses on the San Joaquin River. Water made available to CVP Exchange Contractors would reduce the demand for Delta diversions.

Storage Capacity(ies): 1,400 TAF; 520 TAF existing capacity[1]

Constructibility: No significant constructibility issues identified.

Construction Time: 7 years[1]

Cost: Cost estimates have been indexed to January 1996 dollars from costs presented by the Bureau of Reclamation in 1996 for a reservoir with a gross storage capacity of 1,400 TAF.

Capital ($M): 800[1]
Annual ($M): 0.304[1]
Cost/Acre-Foot ($): 909 (based on the increment of new storage)

Component-Specific Environmental Evaluation: Not determined.

Issues

Legal and Institutional: Not determined.

Water Source: San Joaquin River

Site or Route Land Ownership and Use: Not determined.

Socioeconomic: Not determined.

Preliminary Assessment Considerations

CALFED Program Preference by Surface Storage Type: Low; enlarge on-stream storage

Potential to Contribute to Increases in Water Supply Opportunities: Moderate

Potential to Contribute to Operational Flexibility of the State's Water Resources System: Moderate

The enlargement of this reservoir could provide additional water for use on the San Joaquin River and potentially reduce Delta diversions.

References: [1]Bureau of Reclamation and Fish and Wildlife Service, September 1995, *Least-Cost CVP Yield Increase Plan, Technical Appendix No. 6--Surface Storage and Conveyance*, Department of the Interior.
[2]Bureau of Reclamation, June 1990, *San Joaquin Valley Conveyance Investigation*, Department of the Interior.

Name of Component: Millville Reservoir

Location: Shasta County, South Cow Creek about 15 miles east of Redding near the town of Millville

Surface Storage Map Location: 33

Type of Storage Facility: New on-stream storage

Component Description: Millville Reservoir would consist of an earthfill dam on South Cow Creek. The reservoir would store flows from South Cow Creek and re-regulate releases for uses downstream.

Storage Capacity(ies): Active-200 TAF, gross-206 TAF[2]

Constructibility: No significant constructibility issues identified.

Construction Time: Not determined.

Cost: Cost estimates have been indexed to January 1996 dollars from costs presented by the DWR in 1957 for a reservoir with a gross storage capacity of 206 TAF and an active storage capacity of 200 TAF.

Capital ($M): 55.0[2] (1955 cost-9.32)
Annual ($M): 0.33 (0.6% of capital cost)
Cost/Acre-Foot ($): 275 (based on active storage capacity)

Expected Service Life: 100 years

Component-Specific Environmental Evaluation: Two prehistoric, 2 ethnographic and 7 historic sites exist in project area. Inundate 5 miles of stream habitat, 2,500 acres of foothill woodland, chaparral and grassland habitat. Eliminate 1,000 quail, over 100 deer, a few salmon and steelhead in Cow Creek.[1]

Issues

Legal and Institutional: Not determined.

Water Source: South Cow Creek

Site or Route Land Ownership and Use: Homes are currently being constructed within the proposed project area.

Socioeconomic: Relocation of homes

Preliminary Assessment Considerations

CALFED Program Preference by Surface Storage Type: Lowest; new in-stream storage

Potential to Contribute to Increases in Water Supply Opportunities: Low

Potential to Contribute to Operational Flexibility of the State's Water Resources System: Low

References: [1]Department of Water Resources, September 1988, *Enlarged Shasta Wrap Up Report*, State of California.
[2]Department of Water Resources, May 1957, *The California Water Plan*, Bulletin No. 3, State of California.

Name of Component: Montgomery Reservoir

Location: Stanislaus County, Dry Creek immediately north of the Dry Creek-Merced River confluence near Snelling

Surface Storage Map Location: 34

Type of Storage Facility: New off-stream storage

Component Description: Reservoir would store spills from Lake McClure. A two-way conveyance facility from Merced Falls Reservoir to Montgomery Reservoir has been proposed by the Bureau of Reclamation.[1] The facility would convey up to 2,000 cfs by gravity to Montgomery Reservoir from October through March and about 1,000 cfs to Merced Falls Reservoir from April through September. Releases from New Exchequer Dam would improve streamflows and maintain lower water temperatures in the Merced River. Montgomery Reservoir has also been proposed as part of the East Side Canal project for regulation of flows from the American, Sacramento, and Stanislaus Rivers.[3]

Storage Capacity(ies): Gross-240 TAF[1]

Constructibility: No significant constructibility issues identified.

Construction Time: 4.5 years[1]

Cost: Cost estimates have been indexed to January 1996 dollars from costs presented by the Bureau of Reclamation in 1995 for a reservoir with a gross storage capacity of 240 TAF.

Capital ($M): 148[1] (1992 cost-132)
Annual ($M): 0.89 (0.6% of capital cost)
Cost/Acre-Foot ($): 617 (based on gross storage capacity)

Component-Specific Environmental Evaluation: Loss of 8,000 acres, including riparian and seasonal wetlands important to waterfowl; vernal pools throughout grasslands.

Issues

Legal and Institutional: Not determined.

Water Source: Not determined.

Site or Route Land Ownership and Use: Not determined.

Socioeconomic: Not determined.

Preliminary Assessment Considerations

CALFED Program Preference by Surface Storage Type: High; new off-stream storage

Potential to Contribute to Increases in Water Supply Opportunities: Moderate

Potential to Contribute to Operational Flexibility of the State's Water Resources System: Moderate

Montgomery Reservoir could develop conservation storage in the San Joaquin Valley, which could potentially develop additional water supplies for agricultural and environmental uses on the San Joaquin River.

References: [1]Bureau of Reclamation and Fish and Wildlife Service, September 1995, *Least-Cost CVP Yield Increase Plan, Technical Appendix No. 6--Surface Storage and Conveyance*, Department of the Interior.

[2]Bureau of Reclamation and Fish and Wildlife Service, October 1995, *Least-Cost CVP Yield Increase Plan*, Department of the Interior.
[3]Bureau of Reclamation, June 1966, *East Side Division, Initial Phase, Central Valley Project, California, A Report on the Feasibility of Water Supply Development*, Department of the Interior.

Name of Component: Nashville Reservoir

Location: El Dorado/Sacramento Counties, Cosumnes River approximately five miles north of Plymouth

Surface Storage Map Location: 35

Type of Storage Facility: New on-stream storage.

Component Description: Reservoir would store and regulate flows from the north, middle, and south forks of the Cosumnes River.[3] The reservoir yield would be used for additional water supplies to the Delta, power generation, flood control, fish and wildlife, recreation, and local water service.

Storage Capacity(ies): Gross-900 TAF[2]

Constructibility: Not determined.

Construction Time: Not determined.

Cost: Cost estimates have been indexed to January 1996 dollars from costs presented by Turner in 1993 for a reservoir with a gross storage capacity of 900 TAF.

Capital ($M): 351[2] (1967 cost-70)
Annual ($M): 2.1 (0.6% of capital cost)
Cost/Acre-Foot ($): 390 (based on gross storage capacity)

Component-Specific Environmental Evaluation: 5 prehistoric, 2 ethnographic and 17 historic sites exist in project area. Inundate 20 miles of cold and warm water stream habitat, 6,400 acres of primarily oak woodland and chaparral habitat. Eliminate deer and moderate to large populations of upland game birds and mammals.[1]

Issues

Legal and Institutional: Not determined.

Water Source: Cosumnes River

Site or Route Land Ownership and Use: Combination of public and private lands (approximately 10,000 acres of private lands). Approximately 10 miles of State Highway 49 would need to be relocated.[3]

Socioeconomic: Not determined.

Preliminary Assessment Considerations

CALFED Program Preference by Surface Storage Type: Lowest; new on-stream storage

Potential to Contribute to Increases in Water Supply Opportunities: Moderate

Potential to Contribute to Operational Flexibility of the State's Water Resources System: Moderate

The Cosumnes River is currently one of the last regulated rivers in the Central Valley, and impacts resulting from the development of this facility are likely to be high.

References: [1]Department of Water Resources, September 1988, *Enlarged Shasta Wrap Up Report*, State of California.

[2]Turner, John H., September 1993, *Assessment of Past Mid-Pacific Region, Bureau of Reclamation Planning Activities Involving New Water Supplies.*
[3]Anonymous, August 1982, *Enlarging Shasta Lake Feasibility Study, Description of Alternative Storage Facilities.*

Name of Component: Orestimba Reservoir

Location: Stanislaus County, Orestimba Creek. Dam site is located approximately 2.5 miles west of California Aqueduct and approximately 37 miles south of Clifton Court Forebay.

Surface Storage Map Location: 36

Type of Storage Facility: New off-stream storage

Component Description: This reservoir would be connected to the California Aqueduct to store excess Delta flows which are conveyed through the aqueduct. The additional south-of-Delta storage would increase water supply reliability of the CVP and SWP.

Storage Capacity(ies): Active-295 to 1,137 TAF[2]

Constructibility: No significant constructibility issues identified.

Construction Time: Not determined.

Cost: Cost estimates have been indexed to January 1996 dollars from costs presented by the DWR in 1996 for a reservoir with an active storage capacity of 295 to 1,137 TAF.

Capital ($M): 632-1,819[2] (1996 cost)
Annual ($M): 3.8-10.9 (0.6% of capital cost)
Cost/Acre-Foot ($): 2,142-1,600 (based on active storage capacity)

Component-Specific Environmental Evaluation: Inundate 33 miles of Orestimba Creek. Inundate 2,200 acres of wildlife habitat. Sensitive species probably exist in the reservoir area. Cultural resources also exist in project area.[1]

Issues

Legal and Institutional: Not determined.

Water Source: Sacramento-San Joaquin Delta via the California Aqueduct and the Delta-Mendota Canal.

Site or Route Land Ownership and Use: Not determined.

Socioeconomic: Not determined.

Preliminary Assessment Considerations

CALFED Program Preference by Surface Storage Type: High; new off-stream storage

Potential to Contribute to Increases in Water Supply Opportunities: High

Potential to Contribute to Operational Flexibility of the State's Water Resources System: High

References: [1]Department of Water Resources, May 1984, *Alternative Plans for Offstream Storage South of the Delta*, State of California.
[2]Department of Water Resources, August 1996, *Alternatives South of the Delta, Offstream Reservoir Study*, State of California.

Name of Component: Panoche/Silver Creek Reservoir

Location: Fresno/San Benito Counties, Panoche and Silver Creeks

Surface Storage Map Location: 37

Type of Storage Facility: New off-stream storage.

Component Description: This reservoir would provide off-stream storage for excess Delta flows which would be conveyed through the California Aqueduct. The additional south-of-Delta storage would increase the water supply reliability of the SWP and CVP.

Storage Capacity(ies): Active-158 to 2,647 TAF

Constructibility: No significant constructibility issues identified.

Construction Time: Not determined.

Cost: Cost estimates have been indexed to January 1996 dollars from costs presented by the DWR in 1996 for a reservoir with an active storage capacity of 158 to 2,647 TAF.

Capital ($M): 400-3,042 (1996 cost)
Annual ($M): 2.4-18.3 (0.6% of capital cost)
Cost/Acre-Foot ($): 2,532-1,149 (based on active storage capacity)

Component-Specific Environmental Evaluation: Not determined.

Issues

Legal and Institutional: Not determined.

Water Source: Sacramento-San Joaquin Delta via the California Aqueduct and the Delta-Mendota Canal

Site or Route Land Ownership and Use: Not determined.

Socioeconomic: Not determined.

Preliminary Assessment Considerations

CALFED Program Preference by Surface Storage Type: High; new off-stream storage

Potential to Contribute to Increases in Water Supply Opportunities: High

Potential to Contribute to Operational Flexibility of the State's Water Resources System: High

References: Department of Water Resources, August 1996, *Alternatives South of the Delta, Offstream Reservoir Storage*, State of California.

Name of Component: Pardee Reservoir Enlargement

Location: Calaveras/Amador Counties, Mokelumne River

Surface Storage Map Location: 38

Type of Storage Facility: Enlargement of existing on-stream storage reservoir

Component Description: This reservoir enlargement project has been considered by East Bay MUD as a supply augmentation alternative. Increased storage capacity would be used to capture and regulate Mokelumne River flows to the Mokelumne Aqueduct. Alternatively, increased yields could be used for water supply needs in the Delta.

Storage Capacity(ies): Gross-360 TAF[1] (includes existing capacity of 210 TAF)

Constructibility: No significant constructibility issues have been identified.

Construction Time: 2.5 years[1]

Cost: Cost estimates have been indexed to January 1996 dollars from costs presented by the Bureau of Reclamation in 1995 for the additionally 150 TAF of enlarged storage capacity.

Capital ($M): 226[1] (1992 cost-204)
Annual ($M): 1.3 (0.6% of capital cost)
Cost/Acre-Foot ($): 1,509 (enlargement cost/enlarged gross capacity)

Expected Service Life: 100 years

Component-Specific Environmental Evaluation: Loss of wetland habitat and 4.8 miles of stream, including 3.5 miles of high quality perennial stream; 2 special status plant species possible; the Ione chaparral sensitive plant community. Potential presence of two federally endangered species including bald eagle, loss of spawning habitat for rainbow trout and Kokanee salmon.

Issues

Legal and Institutional: Not determined.

Water Source: Mokelumne River

Site or Route Land Ownership and Use: Not determined.

Socioeconomic: Not determined.

Preliminary Assessment Considerations

CALFED Program Preference by Surface Storage Type: Low; enlarge on-stream storage

Potential to Contribute to Increases in Water Supply Opportunities: Moderate

Potential to Contribute to Operational Flexibility of the State's Water Resources System: Moderate

The Pardee Reservoir Enlargement potentially increase the water supply availability in the central Delta region. This project is currently being investigated by East Bay Municipal Utility District for local development.

References: [1]Bureau of Reclamation, August 1996, *Least-Cost CVP Yield Increase Plan, Technical Appendix No 6*, Department of the Interior.
[2]Bureau of Reclamation and Fish and Wildlife Service, October 1995, *Least-Cost CVP Yield Increase Plan*, Department of the Interior.

Name of Component: Quinto Creek Reservoir

Location: Merced and Stanislaus Counties, Quinto Creek

Surface Storage Map Location: 39

Type of Storage Facility: New off-stream storage

Component Description: This reservoir would provide off-stream storage for excess Delta flows which would be conveyed through the California Aqueduct to this reservoir. The additional south-of-Delta storage would increase the water supply reliability of the SWP and CVP.

Storage Capacity(ies): Active-332 to 381 TAF

Constructibility: Not determined.

Construction Time: Not determined.

Cost: Cost estimates have been indexed to January 1996 dollars from costs presented by the DWR in 1996 for a reservoir with an active storage capacity of 332 to 381 TAF.

Capital ($M): 639-856 (1996 cost)
Annual ($M): 3.8-5.1 (0.6% of capital cost)
Cost/Acre-Foot ($): 1,925-2,246 (based on active storage capacity)

Component-Specific Environmental Evaluation: Not determined.

Issues

Legal and Institutional: Not determined.

Water Source: Sacramento-San Joaquin Delta via the California Aqueduct and the Delta-Mendota Canal

Site or Route Land Ownership and Use: Not determined.

Socioeconomic: Not determined.

Preliminary Assessment Considerations

CALFED Program Preference by Surface Storage Type: High; new off-stream storage

Potential to Contribute to Increases in Water Supply Opportunities: Moderate

Potential to Contribute to Operational Flexibility of the State's Water Resources System: High

References: Department of Water Resources, August 1996, *Alternatives South of the Delta, Offstream Reservoir Study*, State of California.

Name of Component: Red Bank Project (Dippingvat-Schoenfield Project)

Location: Tehama County, South Fork Cottonwood Creek, Red Bank Creek

Surface Storage Map Location: 40

Type of Storage Facility: New on-stream storage-Dippingvat Reservoir; new off-stream storage-Schoenfield Reservoir

Component Description: This project is comprised of a 104 TAF Dippingvat Reservoir; a 2,700-foot-long, 8-foot-diameter tunnel; a 1.2 TAF Langan Reservoir; a 3.5 TAF Bluedoor Reservoir; and a 250 TAF Schoenfield Reservoir. Dippingvat Reservoir would store water from the South Fork of Cottonwood Creek. Water would be diverted from Dippingvat Reservoir to Schoenfield Reservoir via the tunnel and Langan and Bluedoor Reservoirs where it would later be released down Red Bank Creek to the Sacramento River. Water could also be released via a new conveyance facility to the Corning Canal or the Tehama-Colusa Canal.

Storage Capacity(ies): Dippingvat Reservoir-gross-104 TAF; Schoenfield Reservoir-gross-250 TAF

Constructibility: A number of faults occur in and adjacent to the project area.

Construction Time: 3 years

Cost: Cost estimates have been indexed to January 1996 dollars from costs presented by the DWR in 1987 for a reservoir complex with a gross storage capacity of 359 TAF.

Capital ($M): 142 (1986 cost-109.2)
Annual ($M): 0.85 (0.6% of capital cost)
Cost/Acre-Foot ($): 401 (based on gross storage capacity)

Component-Specific Environmental Evaluation: Potential habitat for at least nine species of sensitive plants.

Issues

Legal and Institutional: Not determined.

Water Source: South fork of Cottonwood Creek and Red Bank Creek

Site or Route Land Ownership and Use: Not determined.

Socioeconomic: Not determined.

Preliminary Assessment Considerations

CALFED Program Preference by Surface Storage Type: Lowest; new on-stream storage

Potential to Contribute to Increases in Water Supply Opportunities: Moderate

Potential to Contribute to Operational Flexibility of the State's Water Resources System: High

The Red Bank Project would develop two major on-stream reservoirs, one of which would be used primarily as an off-stream storage facility.

References: Department of Water Resources, November 1987, *The Dippingvat-Schoenfield Project*, State of California.

Name of Component: Romero Reservoir

Location: Merced County, Romero Creek. Dam site is located about 1.8 miles west of the California Aqueduct and less than 1 mile north of O'Neill Forebay.

Surface Storage Map Location: 41

Type of Storage Facility: New off-stream storage

Component Description: From California Aqueduct, a 3,700-foot open channel would convey water to a pumping-generating plant which would pump the water to Romero Reservoir through a 5,300-foot pipeline.

Storage Capacity(ies): Active-184 TAF[2]

Constructibility: No significant constructibility issues identified.

Construction Time: Not determined.

Cost: Cost estimates have been indexed to January 1996 dollars from costs presented by the DWR in 1996 for a reservoir with an active storage capacity of 134 TAF.

Capital ($M): 471[2] (1996 cost)
Annual ($M): 2.8 (0.6% of capital cost)
Cost/Acre-Foot ($): 2,559[2] (based on active storage capacity)

Component-Specific Environmental Evaluation: Inundate approximately 3 miles of Romero Creek, 4 miles of unimproved roads, and 770 acres of wildlife habitat. Sensitive species may exist in project area.[1]

Issues

Legal and Institutional: Not determined.

Water Source: Sacramento-San Joaquin Delta via the California Aqueduct and the Delta-Mendota Canal

Site or Route Land Ownership and Use: Combination of public and private lands

Socioeconomic: Not determined.

Preliminary Assessment Consideration

CALFED Program Preference by Surface Storage Type: High; new off-stream storage

Potential to Contribute to Increases in Water Supply Opportunities: Moderate

Potential to Contribute to Operational Flexibility of the State's Water Resources System: High

References: [1]Department of Water Resources, May 1984, *Alternative Plans for Offstream Storage South of the Delta*, State of California.
[2]Department of Water Resources, August 1996, *Alternatives South of the Delta, Offstream Reservoir Study*, State of California.

Name of Component: Rosewood Reservoir

Location: Shasta/Tehama Counties, Salt Creek and Dry Creek

Surface Storage Map Location: 42

Type of Storage Facility: New on-stream storage

Component Description: This new on-stream storage facility would store flows from Salt and Dry Creeks, tributaries to the south fork of Cottonwood Creek. This reservoir has been considered as an alternative to the Cottonwood Creek projects (i.e., the Cottonwood Creek Complex and the Red Bank Project).

Storage Capacity(ies): Gross-155 TAF

Constructibility: Not determined.

Construction Time: Not determined.

Cost:

Capital ($M): Not determined.
Annual ($M): Not determined.
Cost/Acre-Foot ($): Not determined.

Component-Specific Environmental Evaluation: Not determined.

Issues

Legal and Institutional: Not determined.

Water Source: Salt Creek and Dry Creek

Site or Route Land Ownership and Use: Not determined.

Socioeconomic: Not determined.

Preliminary Assessment Considerations

CALFED Program Preference by Surface Storage Type: Lowest; new on-stream storage

Potential to Contribute to Increases in Water Supply Opportunities: Low

Potential to Contribute to Operational Flexibility of the State's Water Resources System: Low

References: Department of Water Resources, May 1985, *Cottonwood Creek Alternatives*, State of California.

Name of Component: Shasta Lake Enlargement

Location: Shasta County, Sacramento River

Surface Storage Map Location: 43

Type of Storage Facility: Enlargement of existing on-stream storage

Component Description: Enlargement of Shasta Lake could be accomplished by adding to the height of the existing concrete dam or by constructing a new earth and rockfill dam immediately downstream. In addition to increasing water supply, an enlarged reservoir would provide the opportunity to increase average annual power generation and provide additional recreational and flood control benefits.

Storage Capacity(ies): Up to 14,300 TAF of total storage; 9,750 TAF additional gross storage[1,2]

Constructibility: Relocate 14 resorts and 28 public campgrounds; PG&E's Pit No. 7 Power Plant would need to be relocated. Subsurface exploration required to ascertain if dam can be raised 200 feet. Relocate I-5 and Southern Pacific Railroad.

Construction Time: 5 years[2]

Cost: Cost estimates have been indexed to January 1996 dollars from costs presented by the Bureau of Reclamation in 1995 for a reservoir with an additional increment of gross storage capacity of 9,750 TAF.

Capital ($M): 3,364[2] (1992 cost-3,004)
Annual ($M): 155.7[1]
Cost/Acre-Foot ($): 345[2] (enlarged cost/enlarged gross capacity)

Component-Specific Environmental Evaluation: Inundate 30,000 acres of Shasta-Trinity National Recreation Area, portions of Samwell Cave, 4 miles of the McCloud River (Wild and Scenic River), 6 miles of Sacramento River (Wild and Scenic River), 5 percent of salamander area (state listed rare species). Could affect 335 known archeological sites and 126 ethnographic sites. Inundate all recreational developments, 30,000 acres of wildlife habitat. Displace 400 to 500 deer and 100 elk. Forty-two miles of riparian stream vegetation would be lost. Inundate nine bald eagle nesting territories. Loss of river and stream trout habitat. About 42 miles of tributary streams would be inundated. Positive and negative effects for fish in reservoir and Sacramento River.

Issues

Legal and Institutional: Bureau of Reclamation will be required to demonstrate to landowners that seepage problems will not exist along river due to higher summertime flows. (Operation of dam has resulted in lawsuits in the past due to seepage problems.)

Water Source: Pit River, Squaw Creek, McCloud River, and Sacramento River

Site or Route Land Ownership and Use: Combination of public and private lands.

Socioeconomic: 72.4 million board feet of commercial timber would be lost. Eight hundred people relocated including 650 people in communities of Lakehead and Lakeshore (relocating 2 towns). The following recreational developments would be inundated: 800 camp units, 100 picnic units, and many marinas and moorings for 2800 boats. Allows new dry lands to be irrigated for agricultural purposes. Increased power would be generated from the dam. Will provide flood control.[1]

Preliminary Assessment Considerations

CALFED Program Preference by Surface Storage Type: Low; enlarge on-stream storage

Potential to Contribute to Increases in Water Supply Opportunities: High

Potential to Contribute to Operational Flexibility of the State's Water Resources System: High

The enlargement of Shasta Lake would develop significant benefits for downstream flood control, water supply, and regulation for environmental purposes. The project would also likely have significant environmental and socioeconomic impacts.

References: [1]Bureau of Reclamation, September 1983, *Enlarged Shasta Lake Investigation*, Department of the Interior.
[2]Bureau of Reclamation and Fish and Wildlife Service, September 1995, *Least-Cost CVP Yield Increase Plan, Technical Appendix No. 6--Surface Storage and Conveyance*, Department of the Interior.

Name of Component: Sites Reservoir

Location: Colusa/Glenn Counties; Funks and Stone Corral Creeks, 10 miles west of Maxwell

Surface Storage Map Location: 44

Type of Storage Facility: New off-stream storage

Component Description: Water would be diverted to Sites Reservoir from the Sacramento River through Tehama-Colusa and/or Glenn-Colusa Canals in winter months when capacity is available. Alternatively, a new conveyance facility from the Sacramento River near Chico's Landing to the Tehama-Colusa Canal could move excess Sacramento River flows into the reservoir. Water stored at Sites Reservoir would be released for uses in the Delta and to offset diversions for the Tehama-Colusa Canal and possibly the Glenn-Colusa Canal.

Storage Capacity(ies): Active: 1,160 to 1,760 TAF; gross: 1,200 to 1,800 TAF

Constructibility: No insurmountable problems have been identified.

Construction Time: Not determined.

Cost: Cost estimates have been indexed to January 1996 dollars from costs presented by the DWR in 1996 for a reservoir with a gross storage capacity of 1,200 to 1,800 TAF and an active storage capacity of 1,160 to 1,760 TAF.

Capital ($M): 237-464 (1995 cost: 230-450); costs do not include pumping facility, environmental mitigation, and enlargement of Tehama-Colusa Canal
Annual ($M): 1.4-2.8 (0.6% of capital cost)
Cost/Acre-Foot ($): 204-264 (active storage capacity)

Component-Specific Environmental Evaluation: Reservoir would inundate approximately 25 miles of intermittent stream habitat, 12,200 to 14,000 acres of terrestrial wildlife habitat, including 700 acres of oak woodland habitat. Several state or federally listed wildlife species have potential to occur in project area including bald eagle, Swainson's hawk, and bank swallow. Several California species of special concern or federal candidate species exist in the project area, as well as several sensitive plant species. One recorded archaeological site exists in the project area.

Issues

Legal and Institutional: Not determined.

Water Source: Sacramento River

Site or Route Land Ownership and Use: Combination of public and private lands

Socioeconomic: Relocation of communities of Sites (40 people)

Preliminary Assessment Considerations

CALFED Program Preference by Surface Storage Type: High; new off-stream storage

Potential to Contribute to Increases in Water Supply Opportunities: High

Potential to Contribute to Operational Flexibility of the State's Water Resources System: High

References: Department of Water Resources, July 1996, *Reconnaissance Survey - Sites Offstream Storage Project*, State of California.

Name of Component: South Gulch Reservoir

Location: San Joaquin County, South Gulch tributary to Calaveras River

Surface Storage Map Locaton: 45

Type of Storage Facility: New off-stream storage

Component Description: Excess flood flows from the Calaveras and Stanislaus Rivers would be diverted and then conveyed to South Gulch for storage. The storage of excess flows in above normal to wet years would result in an estimated average annual yield of about 65 TAF.

Storage Capacity(ies): Gross-180 TAF[1]

Constructibility: No significant constructibility issues identified.

Construction Time: 2 years

Cost: Cost estimates have been indexed to January 1996 dollars from costs presented by the Bureau of Reclamation in 1995 for a reservoir with a gross storage capacity of 180 TAF.

Capital ($M): 94 (1995 cost-90)
Annual ($M): 0.56 (0.6% of capital cost)
Cost/Acre-Foot ($): 522 (based on gross storage capacity)

Expected Service Life: 100 years

Component-Specific Environmental Evaluation: Loss of grassland and riparian habitat; importation of water from source stream would compete with existing environmental needs of the water including chinook salmon spawning.

Issues

Legal and Institutional: Not determined.

Water Source: Calaveras and Stanislaus Rivers

Site or Route Land Ownership and Use: Not determined.

Socioeconomic: Not determined.

Preliminary Assessment Considerations

CALFED Program Preference by Surface Storage Type: High; new off-stream storage

Potential to Contribute to Increases in Water Supply Opportunities: Low

Potential to Contribute to Operational Flexibility of the State's Water Resources System: Low

References: [1]Bureau of Reclamation and Fish and Wildlife Service, September 1995, *Least-Cost CVP Yield Increase Plan, Technical Appendix No. 6--Surface Storage and Conveyance*, Department of the Interior.

Name of Component: Squaw Valley Reservoir

Location: Shasta County, Squaw Valley Creek (tributary to McCloud River) about eight miles south of the community of McCloud.

Surface Storage Map Location: 46

Type of Storage Facility: New on-stream storage

Component Description: Multipurpose water storage facility upstream of Shasta Lake. Water for storage would come from natural runoff from Squaw Valley Creek and water imported from the upper Sacramento River through 11 miles of tunnels and canals with a 500 cfs capacity.[2] Water from the reservoir would be released to optimize power production and to meet the demands of the CVP and SWP.

Storage Capacity(ies): Gross-400 TAF[1,2]

Constructibility: No significant constructibility issues identified.

Construction Time: Not determined.

Cost:

Capital ($M): Not determined.
Annual ($M): Not determined.
Cost/Acre-Foot ($): Not determined.

Component-Specific Environmental Evaluation: Four prehistoric and 3 historic sites exist in project area. The reservoir would inundate 7 miles of cold water stream habitat, 3,820 acres of mainly coniferous-hardwood forest, chaparral, and riparian habitat. The proposed reservoir area is habitat for deer, elk, black bear, mountain lion, and upland game birds.

Issues

Legal and Institutional: Not determined.

Water Source: Squaw Creek and the upper Sacramento River

Site or Route Land Ownership and Use: Not determined.

Socioeconomic: Not determined.

Preliminary Assessment Considerations

CALFED Program Preference by Surface Storage Type: Lowest; new on-stream storage

Potential to Contribute to Increases in Water Supply Opportunities: Moderate

Potential to Contribute to Operational Flexibility of the State's Water Resources System: Moderate

References: [1]Department of Water Resources, September 1988, *Enlarged Shasta Wrap Up Report*, Department of the Interior.
[2]Anonymous, August 1982, *Enlarging Shasta Lake Feasibility Study, Description of Alternative Storage Facilities.*

Name of Component: Sunflower Reservoir

Location: Kings and Kern Counties, Avenal Creek. The dam site lies 10 miles west of the California Aqueduct and 2 miles west of the existing beginning reach of the Coastal Branch of the California Aqueduct.

Surface Storage Map Location: 47

Type of Storage Facility: New off-stream storage

Component Description: Extensive conveyance system required to transfer water from the California Aqueduct to Sunflower Reservoir. Conveyance system would include 10 miles of new canal and three pumping-generating plants. Reservoir would lie adjacent to the large agricultural service area of the SWP and thereby increase the effective peak water delivery capacity and would eliminate the need for future enlargement of the aqueduct.[1]

Storage Capacity(ies): Active: 322 to 535 TAF[2]

Constructibility: 134 active oil wells are located within Sunflower Reservoir area (well abandonment). Relocation of a portion of State Route 41 and several miles of secondary roads.[1]

Construction Time: Not determined.

Cost: Cost estimates have been indexed to January 1996 dollars from costs presented by the DWR in 1996 for a reservoir with an active storage capacity of 322 to 635 TAF.

Capital ($M): 620-735[2] (1996 cost)
Annual ($M): 3.7-4.4 (0.6% of capital cost)
Cost/Acre-Foot ($): 1,925-1,374 (based on active storage capacity)

Component-Specific Environmental Evaluation: Inundate about 6.5 miles of Avenal Creek, 3.7 miles of Cottonwood Creek, several homes and numerous buildings and structures associated with oil fields. No significant fishery resources exist in the project area. Potential for sensitive species.

Issues

Legal and Institutional: Not determined.

Water Source: Sacramento-San Joaquin Delta via the California Aqueduct and the Delta-Mendota Canal

Site or Route Land Ownership and Use: Combination of public and private lands

Socioeconomic: Loss of oil-field associated benefits[1]

Preliminary Assessment Considerations

CALFED Program Preference by Surface Storage Type: High; new off-stream storage

Potential to Contribute to Increases in Water Supply Opportunities: High

Potential to Contribute to Operational Flexibility of the State's Water Resources System: High

References: [1]Department of Water Resources, May 1984, *Alternative Plans for Offstream Storage South of the Delta*, State of California.
[2]Department of Water Resources, August 1996, *Alternatives South of the Delta, Offstream Reservoir Study* State of California.

Name of Component: Thomes-Newville Reservoir

Location: Glenn County, Thomes and North Fork Stony Creek about 25 miles west of Orland.

Surface Storage Map Location: 48

Type of Storage Facility: New off-stream storage

Component Description: The Newville Dam on the North Fork Stony Creek would store water from the North Fork and adjacent streams, including Thomes Creek and the main stem of Stony Creek. As originally envisioned, there would be diversions from the Sacramento River in this Plan. The enlargement of this project, Glenn Reservoir, would include diversions and off-stream storage of surplus Sacramento River flows.

Storage Capacity(ies): Gross-1,841 TAF[2]

Constructibility: No significant constructibility issues identified.

Construction Time:

Cost: Cost estimates have been indexed to January 1996 dollars from costs presented by the DWR in 1980 for a reservoir with a gross storage capacity of 1,841 TAF.

Capital ($M): 1,086[2] (1980 cost-675)
Annual ($M): 15.5[2]
Cost/Acre-Foot ($): 590 (based on gross storage capacity)

Component-Specific Environmental Evaluation: Inundate 6 miles of Thomes Creek about 20 miles of intermittent streams including North Fork Stony, Salt, and Heifer Creeks; 2,000 acres of critical winter range for an estimated 1,100 deer and 19,000 acres of land would be taken out of general wildlife use. The reservoir site would also inundate several historic and archaeological sites.[1]

Issues

Legal and Institutional: Not determined.

Water Source: Thomes Creek, Stony Creek, and the Sacramento River

Site or Route Land Ownership and Use: Not determined.

Socioeconomic: Not determined.

Preliminary Assessment Considerations

CALFED Program Preference by Surface Storage Type: High; new off-stream storage

Potential to Contribute to Increases in Water Supply Opportunities: High

Potential to Contribute to Operational Flexibility of the State's Water Resources System: High

References: [1]Bureau of Reclamation, July 1974, *Auburn-Folsom South Unit*, Department of the Interior.
[2]Department of Water Resources, November 1980, *Thomes-Newville and Glenn Reservoir Plans*, State of California.

Name of Component: Tuscan Buttes Reservoir

Location: Tehama County, Paynes and Inks Creeks adjacent to the Sacramento River about 10 miles northeast of Red Bluff.

Surface Storage Map Location: 49

Type of Storage Facility: New off-stream storage.

Component Description: Surplus flows from the Sacramento River would be diverted into an off-stream forebay-afterbay reservoir adjacent to the river from which water would be pumped into Tuscan Buttes Reservoir for storage. Releases would be made as required through a pumping-generating plant back into the Sacramento River.[2]

Storage Capacity(ies): Gross-3,675 to 5,500 TAF[1]; gross-3,675 TAF[3]

Constructibility: No significant constructibility issues identified.

Construction Time: Not determined.

Cost: Cost estimates have been indexed to January 1996 dollars from costs presented by Turner in 1993 for a reservoir with a gross storage capacity of 3,675 TAF.

Capital ($M): 1,770[3] (1970 cost-476)
Annual ($M): 10.6 (0.6% of capital cost)
Cost/Acre-Foot ($): 482 (based on gross storage capacity)

Expected Service Life: 100 years

Component-Specific Environmental Evaluation: 7 prehistoric, 1 ethnographic and 7 historic sites exist in project area. Inundate 6 miles of permanent cold-water stream habitat, 19,000 acres of primarily blue oak woodland and grassland habitat. Eliminate steelhead and salmon in Paynes and Inks Creeks. May reduce salmon populations in Sacramento River.[1]

Issues

Legal and Institutional: Not determined.

Water Source: Paynes and Inks Creeks and the Sacramento River

Site or Route Land Ownership and Use: Not determined.

Socioeconomic: Not determined.

Preliminary Assessment Considerations

CALFED Program Preference by Surface Storage Type: High; new off-stream storage

Potential to Contribute to Increases in Water Supply Opportunities: High

Potential to Contribute to Operational Flexibility of the State's Water Resources System: High

The development of this project could have significant impacts on fisheries in the upper Sacramento River resulting from diversions.

References: [1]Department of Water Resources, September 1988, *Enlarged Shasta Wrap Up Report*, State of California.

[2]Bureau of Reclamation, July 1974, *Auburn-Folsom South Unit*, Department of the Interior.
[3]Turner, John H., September 1993, *Assessment of Past Mid-Pacific Region, Bureau of Reclamation Planning Activities Involving New Water Supplies.*

Name of Component: Waldo Reservoir

Location: Yuba County, Dry Creek (Yuba River tributary), dam located 9 miles northeast of Wheatland.

Surface Storage Map Location: 50

Type of Storage Facility: New off-stream storage

Component Description: Waldo Reservoir would serve as an off-stream storage facility for surplus Yuba River flows diverted from Englebright Dam. Flows from Deer Creek, the Bear River, and local runoff from Dry Creek would also be stored in this facility.

Storage Capacity(ies): Gross-300 TAF[1]; active-290 TAF, gross-300 TAF[2]; gross-60 TAF[3]; gross-200 to 300 TAF[4]

Constructibility: Site is considered ideally suited for an earthfill dam.[3]

Construction Time: 1-½ years[3]

Cost: Cost estimates have been indexed to January 1996 dollars from costs presented by Bookman-Edmonston Engineering, Inc. in 1996 for a reservoir with a gross storage capacity of 300 TAF and an active storage capacity of 200 TAF.

Capital ($M): 120-170[4] (1996 cost)
Annual ($M): 1.0 (0.6% of $170 million)
Cost/Acre-Foot ($): 600-567[4] (based on gross storage capacity)

Expected Service Life: 100 years

Component-Specific Environmental Evaluation: Reservoir will not inundate any cultivated or inhabited land. Portions of Waldo-Grass Valley and Waldo-Smartville County Roads would be submerged and will need to be relocated.[3]

Issues

Legal and Institutional: Not determined.

Water Source: Dry Creek, Yuba River via diversion from Englebright Reservoir, Deer Creek, and Bear River

Site or Route Land Ownership and Use: Dam site and about one-half of reservoir area are located within boundaries of Beale Air Force Base. Portion of reservoir is located in Nevada County.[3]

Socioeconomic: Not determined.

Preliminary Assessment Considerations

CALFED Program Preference by Surface Storage Type: High; new off-stream storage

Potential to Contribute to Increases in Water Supply Opportunities: Moderate

Potential to Contribute to Operational Flexibility of the State's Water Resources System: Moderate

References:
[1]Turner, John H., September 1993, *Assessment of Past Mid-Pacific Region, Bureau of Reclamation Planning Activities Involving New Water Supplies.*
[2]Department of Water Resources, May 1957, *The California Water Plan* - Bulletin No. 3, State of California.
[3]International Engineering Company, March 1962, *Preliminary Investigation of Waldo Storage Project.*

[4]Bookman-Edmonston Engineering, Inc. June 1996, *Reconnaissance Evaluation of Waldo Project.*

Name of Component: Wing Reservoir

Location: Tehama County, Inks Creek

Surface Storage Map Location: 51

Type of Storage Facility: New on-stream storage for off-stream storage purposes

Component Description: This new on-stream reservoir would be located on Inks Creek at the same location as the Tuscan Buttes Reservoir. Wing Reservoir would store only flows from Inks Creek and flows diverted by gravity from adjacent Paynes and Battle Creeks. DWR in its 1957 California Water Plan--Bulletin 3 estimated the seasonal yield of this reservoir at about 74,500 acre-feet.

Storage Capacity(ies): Gross-244 TAF[1]; active-222 TAF, gross-243 TAF[2]

Constructibility: No significant construction issues identified.

Construction Time: Not determined.

Cost: Cost estimates have been indexed to January 1996 dollars from costs presented by the DWR in 1957 for a reservoir with a gross storage capacity of 243 TAF and an active storage capacity of 222 TAF.

Capital ($M): 42[2] (1955 cost-7.15)
Annual ($M): .25[2] (0.6% of capital cost)
Cost/Acre-Foot ($): 189[2] (based on active storage capacity)

Expected Service Life: 100 years

Component-Specific Environmental Evaluation: Inundate several miles of warm water habitat, 5,200 acres of primarily foothill woodland habitat. Eliminate 200 deer and many quail and turkey. May reduce salmon and steelhead population.

Issues

Legal and Institutional: Not determined.

Water Source: Inks Creek and flows diverted from Paynes and Battle Creeks

Site and Route Land Ownership and Use: Not determined.

Socioeconomic: Not determined.

Preliminary Assessment Considerations

CALFED Program Preference by Surface Storage Type: Lowest; new on-stream storage

Potential to Contribute to Increases in Water Supply Opportunities: Low

Potential to Contribute to Operational Flexibility of the State's Water Resources System: Moderate

References: [1]Turner, John H., September 1993, *Assessment of Past Mid-Pacific Region, Bureau of Reclamation Planning Activities Involving New Water Supplies.*
[2]Department of Water Resources, May 1957, *The California Water Plan*, Bulletin No. 3, State of California.

Appendix B
Groundwater Storage Attribute Matrices

Preliminary Working Draft
CALFED-Bay-Delta Program
Storage and Conveyance Component Inventories

February 28, 1997

INTRODUCTION

Appendix B of the technical memorandum on *Storage and Conveyance Component Inventories* provides attribute matrices for each of the groundwater storage components identified in the Groundwater Storage Components section of the technical memorandum. The attribute matrices contain information on the various attributes or characteristics of the groundwater storage component, such as location, existing conditions, storage capacities, and other characteristics. The purpose of this information is to provide CALFED with a full range of potential groundwater storage components to be considered in the formulation of storage and conveyance alternatives developed in Phase II of the CALFED process.

Groundwater storage components and the information for the attribute matrices have been identified from past and current investigations. In nearly all instances, information for one or more of the attributes was not unavailable in existing reports or studies. As the investigation of storage and conveyance alternatives continues, the attribute matrices for selected groundwater storage components will be investigated in greater detail.

The inclusion of any particular groundwater storage component does not represent an endorsement of that component by CALFED. The groundwater storage components identified in the technical memorandum on Storage and Conveyance Component Inventories and the information presented within this appendix represent groundwater storage projects which have been investigated or are being investigated and which have the potential to contribute to the objectives of the CALFED Program.

DESCRIPTION OF ATTRIBUTE MATRICES

The attribute headings for the groundwater storage component attribute matrices are slightly different than the attribute headings for the surface storage or the conveyance matrices. Presented below are the attribute headings, with explanations that have been used for the groundwater storage components.

Name of Component - This attribute identifies the name of the component. For most sites, the name of the groundwater storage component refers to the region in which the project would occur.

Location - The location contains the county in which the component is located and more specific information if appropriate.

Groundwater Site Map Location - Identifies the location number of the groundwater storage component used in Figure 2.

Type of Operation - Describes the basic type of groundwater storage opportunity being considered. Two basic types of operation are:

- *Groundwater Banking:* The delivery of surface water to a site for artificial recharge by either well injection and/or spreading in percolation basins during years of abundant supply; the water would later be extracted from the site and returned to the system.

- *Conjunctive Use:* The delivery of surface water during periods of abundant supply to a site that is otherwise dependent on groundwater; the delivery, by virtue of using this water in lieu of groundwater pumping, recharges the groundwater basin. The supply is retrieved during years of deficiency by having adjoining areas forgo surface water deliveries and switching to groundwater.

Gross Storage Capacity/Depth Range - Identifies the estimated groundwater storage capacity of the component with a corresponding range of depths used to estimate capacity. Unless previously developed, as indicated in the matrix, the storage volume is the gross volume estimated from the area of the site, a specific yield, and the depth range. This volume is not necessarily the active volume that could be utilized. For basins that have not been extensively utilized, the depth of storage to be used was approximately two-thirds of the average existing well depth.

Active Storage Capacity - Active capacity is estimated by assuming an induced cone of depression shaped similarly to a half-ellipsoid that is restricted from a one-mile band of any river. To the extent that such a volume exceeds the exchangeable dry-period (1929-1934) supply, the latter is considered the active storage. The exchangeable dry-period supply is an approximation of the average annual supply over the historical dry period of 1929 through 1934. For this analysis, the average dry period supply was estimated as 75 percent of the average irrigation delivery for the six years. Active storage includes priority storage that would be reserved for existing local users.

Operation to Exceed Historical Maximum Depth - Indicates whether, and to what extent, the postulated groundwater operation would exceed the historical maximum depth to groundwater for the region being considered (see *Gross Storage Capacity/Depth Range).*

Infrastructure Required - Capacities listed are the expected maximums as determined to provide peak-month delivery. To the extent that off-peak capacity can be effectively utilized, these facility requirements could be reduced. Infrastructure requirements will also depend on proposed operations, which have not been fully addressed at this point.

Conveyance Facility - Indicates whether the site is dependent on extending or developing an additional major conveyance facility. If cost data are available, a pro rata allocation of planned capacity listed in the conveyance component section is listed.

Recharge/Distribution System - Recharge for most sites is considered to be achieved through surface delivery in lieu of groundwater to those areas served solely by groundwater. Capacity is estimated based on peak monthly delivery of 20 percent of the

annual requirement. The annual requirement was assumed to be four feet in the Sacramento Basin and three feet in the San Joaquin Basin.

Extraction - For surface water service areas, well field development is sized based on an irrigation demand peak monthly delivery of 20 percent of the annual requirement. This was limited such that under the irrigation demand, the estimated active storage would be extracted over the six-year dry period.

Long-Term Regional Conditions - Describes the condition of the regional groundwater basin relative to the extent it is presently utilized. Basins described as full are unlikely to have experienced long-term overdraft; whereas, basins described as dewatered should be evaluated relative to potential for existing long-term overdraft.

Cost - The cost of a component is separated into estimated capital and annual costs (estimated from prior studies and adjusted to 1996 dollars using the Consumer Price Index). Annual O&M costs do not include power costs. The general procedure for escalating the cost of facilities is as follows:

- If conveyance is needed and costs have been determined, a prorated cfs-mile share is included in the total.
- The cost of recharge/distribution facilities is based on $2,600 per acre for pipeline systems, representative of facilities now being constructed for the Semitropic Water Storage District.
- Well field systems are based on recent experiences in Kern County, where the average cost of a 4.5-cfs well is approximately $175,000 (roughly $39,000 per cfs).
- If O&M costs were not specified in previous studies, it was assumed that the annual O&M costs are 2 percent of the total construction cost for pipelines, pumping plants, power plants, and canals. Although power costs would be substantial, the relative difference between alternative projects is not expected to be a distinguishing factor within each region; accordingly, power costs are not included.

Cost/Unit of Capacity - The cost per unit of capacity was calculated as the capital cost divided by the active capacity of the facility. If the capacity is larger than the estimated ability to extract or exchange water over the 1929 through 1934 dry period, the exchange volume is used as the denominator.

Component-Specific Environmental Evaluation - This evaluation is in the form of a brief description of the environmental concerns associated with developing the proposed project. The description is limited to the specific project/component and does not include indirect environmental impacts/benefits for the Bay-Delta system. The impacts of a given

component and all other related components will be undertaken in the formal impact analysis of the EIR/EIS.

Issues

Legal and Institutional - This attribute includes a general description of legal or institutional issues that could hinder the development of the project; for example, the existence of adjudicated groundwater basins or groundwater ordinances which might prohibit the development of groundwater resources for non-local users.

Source Water Quality - This attribute generally indicates the quality of water as indicated by the source of the water.

Groundwater Quality - If quality of the groundwater is identified as a possible concern in either the referenced material or through other experience, the nature of the concern is listed.

Site or Route Land Ownership and Use - The alignment of a conveyance facility or the acquisition of land for spreading or well field operation is examined to determine if the site or alignment overlaps lands that cannot be affected according to state and federal laws. Additionally, this issue addresses the relative number of entities outside of CALFED with which operation would need to be coordinated.

Socioeconomic - Socioeconomic impacts are identified with regard to potential third-party impacts, changing land uses, or right-of-way considerations.

Preliminary Assessment Considerations - This attribute generally describes the compatibility of this component with other components and with the program objectives. Preliminary operational assessment is provided as to either the ability to capture surplus flows or the dependence of the project on transfer from surface water storage. Additionally, observations are made on the possible loss of yield potential when considering streamflow accretion and seepage impacts.

References - The source or sources of information used to complete the attribute matrix are listed.

GROUNDWATER STORAGE COMPONENT ATTRIBUTE MATRICES

Provided on the following pages are attribute matrices for each of the 17 groundwater storage components identified in Table 2 of the technical memorandum on *Storage and Conveyance Inventories*. The following attribute matrices are ordered alphabetically by the name of the component.

Name of Component: Butte Basin

Location: Butte County area between the Feather River and Butte Creek.

Groundwater Site Map Location: 1

Type of Operation: Conjunctive use. The existing surface water distribution system could be expanded into the areas presently relying on groundwater. The existing surface water distribution system could then be equipped with groundwater capacity sufficient to utilize the identified storage.

Gross Storage Capacity/Depth Range: The gross storage capacity is about 960,000 acre-feet for a depth range of 30 to 150 feet.

Active Storage Capacity: With an assumed cone of depression shaped to fit within the basin, exclusive of a one-mile band adjacent to the rivers, the active storage is estimated to be about 470,000 acre-feet.

Operation to Exceed Historical Maximum Depth: Yes. This basin has not been regularly operated as a major source of supply. However, groundwater has been pumped for the State Water Drought Bank. The historical, pre-drought, maximum depths were about 50 feet and would be exceeded by about 100 feet to utilize the storage volumes indicated above.

Infrastructure Required:

Conveyance Facility: None.
Recharge/Distribution System: The existing surface water distribution system would be extended to serve the estimated 16,000 acres of lands presently relying on groundwater (210 cfs capacity).
Extraction: About 260 cfs of well field capacity would be constructed to serve lands from groundwater in lieu of surface water.

Long-Term Regional Conditions: Stable water levels with a full basin.

Cost:
Capital ($M): $51
Annual ($/M): $1.0
Unit Cost ($/acre-foot): $109

Component-Specific Environmental Evaluation: To be determined.

Issues:

Legal and Institutional: The area has not experienced extensive conjunctive operation. The initial draft from the basin may be an issue. A local ordinance has been adopted that will need to be integrated into the conceptual plans for groundwater management.
Source Water Quality: Feather River and Butte Creek.
Groundwater Quality: To be determined.
Site or Route Land Ownership and Use: Existing agricultural area--multiple ownership.
Socioeconomic: Requires drafting a basin that has not been heavily used in the past. Although existing wells typically reach 300 feet, additional power costs and resetting of pumps may be required.

Preliminary Assessment Considerations: Compatibility of this project may be affected by the proximity to the Feather River and Butte Creek. The potential stream seepage losses resulting from operation of the basin would impair water supply opportunity.

References:
Department of Water Resources, August 1978, *Evaluation of Ground Water Resources: Sacramento Valley*, Bulletin 118-6, State of California.

Name of Component: Cache Creek Fan

Location: The area surrounds Woodland in eastern Yolo County east of the foothills and west of the Sacramento River.

Groundwater Site Map Location: 2

Type of Operation: Conjunctive use. The area consists of 82,000 acres of existing groundwater-irrigated land and 81,000 acres of existing surface water-irrigated land. Conveyance is needed to deliver wet-year surface water and to recover forgone Cache Creek supplies in wet years.

Gross Storage Capacity/Depth Range: Storage is 1,230,000 acre-feet for a depth range of 20 to 150 feet.

Active Storage Capacity: With an assumed cone of depression shaped to fit within the basin, exclusive of a one-mile band adjacent to the rivers, the active storage is estimated to be about 1,110,000 acre-feet. However, the surface supply to the area is limited to storage available in Clear Lake and Indian Valley Reservoir. Assuming that at most 75 percent of the carryover storage is available, the exchangeable supply is limited to 450 TAF.

Operation to Exceed Historical Maximum Depth: Yes. The basin has been utilized for local supply in certain areas and may be in overdraft; however, the average depth of wells in the area would allow additional fluctuation provided possible long-term overdraft is abated. The additional depth would be on the order of about 50 feet.

Infrastructure Required:

Conveyance Facility: Extension of the Tehama-Colusa Canal is the major supply-side requirement to deliver water for banking. An equally costly feature would be the exchange/export facility that provides the opportunity for delivering local surface supplies to the Sacramento River during dry years.
Recharge/Distribution System: The distribution system was limited to 250 cfs to match the dry-period extraction capacity. If fully extended to the Davis area, filtration costs would be added.
Extraction: The extraction was limited to 250 cfs, the peak rate necessary to extract the active storage during the dry period for irrigation purposes.

Long-Term Regional Conditions: The basins have been partially dewatered and should be evaluated for potential of existing long-term overdraft.

Cost: Data are incomplete because the conveyance costs to and from this site and the Sacramento River need to be determined.

Capital ($M): $58 plus conveyance cost
Annual ($M): $1.2
Unit Cost ($/acre-foot): $130 plus conveyance cost

Component-Specific Environmental Evaluation: Land subsidence has occurred in the area. Other impacts to be determined.

Issues:

Legal and Institutional: The County is in the process of adopting a groundwater ordinance.
Source Water Quality: Sacramento River.
Groundwater Quality: To be determined.
Site or Route Land Ownership and Use: Existing agricultural area with expanding suburban influence.
Socioeconomic: To be determined.

Preliminary Assessment Considerations: The project may provide an opportunity to capture winter surplus flow by spreading in the Cache Creek fan. The project could be integrated as part of off-stream storage in Lake Berryessa.

References: Department of Water Resources, August 1978, *Evaluation of Ground Water Resources: Sacramento Valley*, Bulletin 118-6, State of California.

Montgomery Watson and West Yost & Associates, May 1996, *City of Davis Future Water Supply Study (Phase II).*

Name of Component: Colusa County

Location: The area is in the vicinity of Arbuckle east of the foothills and west of the Colusa Basin Drain between the town of Williams and the Yolo County line.

Groundwater Site Map Location: 3

Type of Operation: Conjunctive use. The site included equal areas of groundwater and surface water reliance, consisting of 34,600 acres of existing groundwater-irrigated land which would be developed for surface water and 34,600 acres of existing surface water-irrigated land which would be developed for dry-year groundwater irrigation.

Gross Storage Capacity/Depth Range: About 885,000 acre-feet of storage is estimated for a depth range of 30 to 300 feet.

Active Storage Capacity: With an assumed cone of depression shaped to fit within the basin, exclusive of a one-mile band adjacent to the rivers, the operable storage is estimated to be about 320,000 acre-feet.

Operation to Exceed Historical Maximum Depth: Yes. This basin has not been operated as a major source of supply. Historical maximum depths of about 100 feet would be exceeded by about 200 feet.

Infrastructure Required:

Conveyance Facility: No.
Recharge/Distribution System: Distribution system with 180 cfs capacity to serve the 13,500 acres of the land presently reliant on groundwater is needed.
Extraction: Well field development of 180 cfs is needed for dry-year in-lieu service to the present surface water service area.

Long-Term Regional Conditions: Groundwater levels appear stable with a full basin.

Cost: The increased depth to water would likely require additional capital cost to deepen existing wells. Such costs are not included.

Capital ($M): $42
Annual ($M): $0.8
Unit Cost ($/acre-foot): $132

Component-Specific Environmental Evaluation: To be determined.

Issues:

Legal and Institutional: To be determined.
Source Water Quality: Upper Sacramento River.
Groundwater Quality: Poor quality in localized areas.
Site or Route Land Ownership and Use: Existing agricultural area.
Socioeconomic: The basin has not been extensively operated. The initial draft from the basin may be an issue.

Preliminary Assessment Considerations: This project may provide an opportunity to meet drought conditions, thereby increasing the reliability of the State's water resources through a conjunctive use operation.

References: Department of Water Resources, August 1978, *Evaluation of Ground Water Resources: Sacramento Valley*, Bulletin 118-6, State of California.

Name of Component: Eastern Sutter County

Location: Sutter County east of the Feather River between the Bear River and Sacramento County.

Groundwater Site Map Location: 4

Type of Operation: Conjunctive use. About 11,500 of the 15,400 acres served by surface water would be developed to rely on groundwater in dry years. An equivalent amount of groundwater service area would be converted for surface deliveries in wet years.

Gross Storage Capacity/Depth Range: About 1,020,000 acre-feet of storage is available for a depth range of 30 to 200 feet.

Active Storage Capacity: The potential active capacity of about 470,000 acre-feet is calculated based on a cone of depression shaped as a half-ellipsoid fit within the assumed depth and an area that excludes a one-mile band adjacent to adjoining rivers. The areas indicated to be reliant on existing surface water supplies would have a substantially lower volume of water for exchange in dry periods. The 11,500 acres may be able to forgo about 280,000 acre-feet during the dry period.

Operation to Exceed Historical Maximum Depth: Yes. Although this basin has been a major source of supply, it has not been operated as extensively as has been considered in this preliminary evaluation. Historical maximum depths of about 100 feet would be exceeded by about 100 feet.

Infrastructure Required:

Conveyance Facility: None.
Recharge/Distribution System: A 150 cfs distribution system would be needed to balance the added groundwater extraction capacity.
Extraction: About 150 cfs of groundwater production capacity would be needed to serve surface water areas that are not adjacent to rivers.

Long-Term Regional Conditions: Stable groundwater conditions locally with potential of existing regional overdraft to the south and east.

Cost:

Capital ($M): $35
Annual ($M): $0.7
Unit Cost ($/acre-foot): $125, based upon dry-period extraction of 280,000 acre-feet.

Component-Specific Environmental Evaluation: To be determined.

Issues:

Legal and Institutional: To be determined.
Source Water Quality: Feather River.
Groundwater Quality: Localized areas of saline groundwater.
Site or Route Land Ownership and Use: Existing agricultural area.
Socioeconomic: The initial draft from the basin may be an issue.

Preliminary Assessment Considerations: A conjunctive use operation in this area could provide additional water supply opportunities by storing surplus flows in wet years and making river flows from the Feather and Yuba Rivers available for other uses in dry years.

References: Department of Water Resources, August 1978, *Evaluation of Ground Water Resources: Sacramento Valley*, Bulletin 118-6, State of California.

Name of Component: Sacramento County

Location: Sacramento County south of American River.

Groundwater Site Map Location: 5

Type of Operation: Conjunctive use. A large portion of this basin has been converted or is in the process of converting to suburban development; accordingly, this assessment assumes delivery of both treated and raw water supplies to areas presently served by groundwater. Groundwater wells would be developed for roughly 10,000 acres in the present surface water service area. The surface water supply provided in lieu of groundwater would be recovered in dry years through forgone surface water diversion.

Gross Storage Capacity/Depth Range: Approximately 560,000 acre-feet for a depth range of 30 to 150 feet.

Active Storage Capacity: The estimated active capacity of about 260,000 acre-feet is calculated as a half-ellipsoid fit within a mile of the rivers encompassing the basin and the assumed depth. Assumes exchangeable supply through development of existing City of Sacramento CVP entitlement.

Operation to Exceed Historical Maximum Depth: Yes. Portions of the basin on the periphery of the existing cone of depression would be operated resulting in average depths of about 50 feet below the historical maximums.

Infrastructure Required:

Conveyance Facility: None; however, the existing distribution system is probably sized to take advantage of multiple sources (wells) versus a single treated river source. Accordingly, costs may be understated.

Recharge/Distribution System: Distribution system extensions totaling 140 cfs would be required to serve areas presently on groundwater. It was assumed one-half of the in-lieu supply would be for potable uses and one-half for irrigation. One-half of the capacity shown would not require new distribution facilities, but would require additional filtration/treatment systems (at $2 million per mgd) to serve the peak demand.

Extraction: Extraction to serve the existing surface water service area is estimated at 90 cfs.

Long-Term Regional Conditions: The basin has been partially dewatered in the south. Groundwater levels appear to have downward trends.

Cost: The nominal recharge capacity (for irrigation service) was adjusted to reflect one-half of the groundwater areas to be served treated service water. Treatment costs are a substantial component at $2 million per mgd.

Capital ($M): $76
Annual ($M): $1.5
Unit Cost ($/acre-foot): $293

Component-Specific Environmental Evaluation: To be determined.

Issues:

Legal and Institutional: To be determined.

Source Water Quality: Sacramento and American Rivers.

Groundwater Quality: Use of groundwater for potable supplies requires special treatment for taste and odor control.

Site or Route Land Ownership and Use: Existing agricultural area and suburban development.

Socioeconomic: To be determined.

Preliminary Assessment Considerations: The development of a groundwater conjunctive use program in this area would likely be best suited to service the growing local demand. This project would not create significant water supply opportunities for the State's water resources system.

References: Department of Water Resources, August 1978, *Evaluation of Ground Water Resources: Sacramento Valley*, Bulletin 118-6, State of California.

Name of Component: Stony Creek Fan

Location: Located in Glenn County east of the coastal foothills west of the Sacramento River.

Groundwater Site Map Location: 6

Type of Operation: Conjunctive use and spreading. The area would consist of 84,500 acres of existing groundwater-irrigated land and 230,400 acres of existing surface water-irrigated land. Surface water deliveries from the Tehama-Colusa Canal could be increased to serve an additional 26,000 acres of land presently using groundwater. Recharge available in Stony Creek and along the fringes of the creek would enable capture of winter surplus flows. Extraction for use in lieu of surface deliveries was limited to the estimated dry-period exchangeable supply.

Gross Storage Capacity/Depth Range: Storage is 1,370,000 acre-feet for a depth range of 20 to 150 feet.

Active Storage Capacity: With an assumed cone of depression shaped to fit within the basin, the active storage is estimated to be about 640,000 acre-feet.

Operation to Exceed Historical Maximum Depth: Yes. This basin has not been operated as a major source of supply. Historical maximum depths of about 50 feet would be exceeded by about 100 feet.

Infrastructure Required:

Conveyance Facility: None.

Recharge/Distribution System: Although the creekbed may be available for recharge during the dry months, costs were estimated based on serving surface water to about 26,000 acres of groundwater-irrigated land which would balance the acreage developed for groundwater extraction. About 360 cfs of distribution capacity would be required.

Extraction: About 360 cfs of extraction capacity would be needed to extract irrigation supplies for a 26,000 acre portion of the existing surface water service area. The assumed cone of depression and associated active capacity are limiting factors for extraction potential.

Long-Term Regional Conditions: Stable water levels with a relatively full basin.

Cost:
Capital ($M): $82
Annual ($M): $1.6
Unit Cost ($/acre-foot): $130

Component-Specific Environmental Evaluation: To be determined.

Issues:

Legal and Institutional: Glenn County has adapted an ordinance regulating groundwater basin operation.
Source Water Quality: Sacramento River and Tehama-Colusa Canal.
Groundwater Quality: To be determined.
Site or Route Land Ownership and Use: Existing agricultural area.
Socioeconomic: The area has experienced only minimal conjunctive operation. The initial draft from the basin may be an issue.

Preliminary Assessment Considerations: Provides opportunity to capture winter surplus flows as well as in-lieu conjunctive use. The areas of extraction would have minimal effect on the Sacramento River accretion.

References:

Department of Water Resources, August 1978, *Evaluation of Ground Water Resources: Sacramento Valley*, Bulletin 118-6, State of California.
Bureau of Reclamation, August 1994, *American River Water Resources Investigation, Draft Water-related Needs Assessment, Volume 2*, Department of the Interior.

Name of Component: Sutter County

Location: With the exception of the Sutter Buttes, the basin encompasses the area of Sutter County between the Feather and Sacramento Rivers.

Groundwater Site Map Location: 7

Type of Operation: Conjunctive use. The area consists of 32,000 acres of existing groundwater-irrigated land and about 133,000 acres of existing surface water-irrigated land. About 55,000 acres of the surface water service area would be served by groundwater in dry years. The existing groundwater area would be served surface water in wet years.

Gross Storage Capacity/Depth Range: About 2,320,000 acre-feet of storage is available for a depth range of 30 to 200 feet.

Active Storage Capacity: With an assumed cone of depression shaped to fit within the basin, the active storage is estimated to be about 1,180,000 acre-feet.

Operation to Exceed Historical Maximum Depth: Yes. Only a portion of this basin adjoining the Feather River has relied on groundwater as a major source of supply. Historical maximum depths of about 100 feet would be exceeded by about 100 feet.

Infrastructure Required:

Conveyance Facility: None.
Recharge/Distribution System: A 430 cfs distribution system would be needed to serve the 32,000 acres of land presently served with groundwater.
Extraction: Development of 660 cfs of well field capacity would be needed to serve the 55,000 acres of surface water service area in dry years. This level of service effectively utilizes the active storage.

Long-Term Regional Conditions: Stable groundwater conditions.

Cost:

Capital ($M): $113
Annual ($M): $2.3
Unit Cost ($/acre-foot): $85

Component-Specific Environmental Evaluation: To be determined.

Issues:

Legal and Institutional: To be determined.
Source Water Quality: Feather and Sacramento Rivers.
Groundwater Quality: Known problems with connate groundwater in nearly half the area.
Site or Route Land Ownership and Use: Existing agricultural area.
Socioeconomic: The area is not regularly subjected to extensive conjunctive operation. The initial draft from the basin may be an issue.

Preliminary Assessment Considerations: Compatibility is limited due to proximity of the basins to the Sacramento and Feather Rivers. Basin operation would likely affect river seepage and accretions and consequently impair water supply opportunity.

References:

Department of Water Resources, August 1978, *Evaluation of Ground Water Resources: Sacramento Valley*, Bulletin 118-6, State of California.

Name of Component: Thomes Creek Fan

Location: Located in Tehama County east of the Coastal foothills and west of the Sacramento River.

Groundwater Site Map Location: 8

Type of Operation: Conjunctive use. The area consists of nearly 19,000 acres of existing groundwater-irrigated land and 10,000 acres of existing surface water-irrigated land. The 9,000 acres of surface water-irrigated land would be developed for groundwater irrigation. Surface water deliveries from the Tehama-Colusa and Corning Canals would be increased to serve the 19,000 acres presently served through groundwater. Recharge available in Thomes Creek may reduce the need for distribution costs or increase the rate of basin recharge. Extraction for use in lieu of surface deliveries was limited to the estimated dry-period exchangeable supply.

Gross Storage Capacity/Depth Range: About 580,000 acre-feet of storage for a depth range of 30 to 200 feet.

Active Storage Capacity: With an assumed cone of depression shaped to fit within the basin, the active storage is estimated to be about 220,000 acre-feet.

Operation to Exceed Historical Maximum Depth: Yes. This basin has not been operated as a major source of supply. Historical maximum depths of about 100 feet would be exceeded by about 100 feet.

Infrastructure Required:

Conveyance Facility: None.
Recharge/Distribution System: About 120 cfs of distribution capacity for irrigation of 9,000 acres of groundwater service area to match the extraction capacity. To the extent that spreading in Thomes Creek proves effective, distribution for in-lieu recharge can either be reduced or supplemented.
Extraction: About 120 cfs of new well capacity would be needed to convert sufficient surface water areas to dry-year groundwater use in order to utilize the estimated active storage.

Long-Term Regional Conditions: Stable groundwater levels.

Cost:

Capital ($M): $28
Annual ($M): $0.6
Unit Cost ($/acre-foot): $128

Component-Specific Environmental Evaluation: To be determined.

Issues:

Legal and Institutional: Tehama County has implemented a local ordinance to regulate groundwater operation.
Source Water Quality: Upper Sacramento River.
Groundwater Quality: To be determined.
Site or Route Land Ownership and Use: Existing agricultural area.
Socioeconomic: The area has not experienced extensive conjunctive operation. The initial draft from the basin may be an issue.

Preliminary Assessment Considerations: Provides an opportunity to store surplus winter flows by spreading in the Thomes Creek bed and adjoining areas. Would have minor impact on accretions to the Sacramento River.

References: Department of Water Resources, August 1978, *Evaluation of Ground Water Resources: Sacramento Valley*, Bulletin 118-6, State of California.

Name of Component: Yuba County

Location: The area is located in southwestern Yuba County west of the Sierra foothills and bordered by the Yuba, Feather, and Bear Rivers.

Groundwater Site Map Location: 9

Type of Operation: Conjunctive use through in-lieu operations. The area consists of 87,000 acres of existing groundwater-irrigated land and 81,000 acres of existing surface water-irrigated land. The land presently served with groundwater would be developed for surface water irrigation. Those lands served with surface water have historically utilized groundwater; accordingly, no additional well development would be necessary.

Gross Storage Capacity/Depth Range: Capacity south of the river is estimated to be about 540,000 acre-feet for depths of between 20 and 100 feet.

Active Storage Capacity/Depth Range: The historical draft of about 100 feet was estimated to have extracted about 280,000 acre-feet out of the gross capacity of 540,000 acre-feet. .

Operation to Exceed Historical Maximum Depth: No. The basin has historically been utilized to this extent for local supply.

Infrastructure Required:

Conveyance Facility: No new major conveyance facility would be required.
Recharge/Distribution System: Only an additional 160 cfs of distribution capacity would be required to match the dry-period extraction capacity that would utilize the active storage.
Extraction: As the majority of the area has recently developed surface supplies for areas formerly reliant on groundwater, no additional extraction capacity would be required.

Long-Term Regional Conditions: Stable yet partially dewatered groundwater basin. Recent trends show increasing water levels.

Cost: The only major additional cost item would be construction of a distribution system in the areas currently reliant on groundwater.

Capital ($M): $31
Annual ($M): $0.6
Unit Cost ($/acre-foot): $111

Component-Specific Environmental Evaluation: To be determined.

Issues:

Legal and Institutional: To be determined.
Source Water Quality: Yuba River.
Groundwater Quality: To be determined.
Site or Route Land Ownership and Use: Existing agricultural areas with multiple water purveyors. The principal umbrella agency, Yuba County Water Agency, is actively planning local groundwater management.
Socioeconomic: To be determined.

Preliminary Assessment Considerations: Due to proximity to the Feather River, operation of the presently dewatered basin would reduce seepage losses and further water supply opportunity.

References: Bookman-Edmonston Engineering, Inc., September 1992, *Ground Water Resources and Management in Yuba County.*

Name of Component: Folsom South Canal Area

Location: Southeastern San Joaquin County

Groundwater Site Map Location: 10

Type of Operation: Conjunctive use. Delivery of surface water from the American River (or Sacramento River through a Hood-Clay connection) would be used in lieu of groundwater in the Stockton East WD and South San Joaquin ID areas. This would reduce the rate of underflow recharging the Stockton East WD area from the South San Joaquin ID area and thereby make it possible to use groundwater in the South San Joaquin ID area in lieu of diversions from the Stanislaus River. Those undiverted supplies could then be scheduled for release to the Delta from New Melones Reservoir.

Gross Storage Capacity/Depth Range: 1.8 million acre-feet of estimated gross storage available between depths of 30 to 130 feet.

Active Storage Capacity: The estimated usable groundwater storage in the region is about 860,000 acre-feet; however, assuming that one-half of the dry period supply to South San Joaquin is available, the exchangeable dry period supply is about 740,000 acre-feet.

Operation to Exceed Historical Maximum Depth: Yes. In South San Joaquin ID, water levels would be reduced; however, the overdrafted area where water is stored would have generally higher water levels.

Infrastructure Required:

Conveyance Facility: Extension of the Folsom South Canal to the Farmington area would be the cornerstone of this project. An alternative (additional) cost not included could be a Hood-Clay connector to the Sacramento River to avoid American River diversion issues.

Recharge/Distribution System: Existing surface water distribution systems would need expansion (400 cfs) to allow full surface water delivery in wetter years.

Extraction: Development of groundwater capacity in the South San Joaquin ID to produce dry year supplies of 400 cfs is expected.

Long-Term Regional Conditions: The area considered for in-lieu recharge has a steady decline in groundwater levels and is probably in a state of long-term overdraft which could impair long-term water supply opportunity.

Cost: The cost includes an allocation of about 6 percent of Folsom South Canal extension which probably understates the separable costs. Accordingly, the costs shown are probably low relative to costs based on more likely project allocations.

Capital ($M): $100

Annual ($M): $2

Unit Cost ($/acre-foot): $140 (based on total exchangeable six-year supply from New Melones Reservoir of about 740,000 acre-feet.

Extended Service Life: 20 years to indefinite depending on long-term abatement of overdraft.

Component-Specific Environmental Evaluation: Diversion impacts to American River and/or Sacramento River. Instreamflow benefits to the Stanislaus and lower San Joaquin Rivers.

Issues:

Legal and Institutional: The ability to divert surface water at Nimbus Dam has been successfully challenged in litigation. Additionally, this program would require agreements between Stockton East WD and South San Joaquin ID. In order to complete the conveyance system, additional supply and cost-sharing by Stockton East WD would be a likely requirement.

Source Water Quality: Sacramento, American, and Stanislaus Rivers.

Groundwater Quality: Areas of the Stockton East WD have poor quality groundwater which would be improved with this program.

Site or Route Land Ownership and Use: To be determined.
Socioeconomic: To be determined. Provides cost-sharing opportunity for increased import which would offset overdraft and thereby sustain the local economy.

Preliminary Assessment Considerations: This site satisfies multiple purposes, although the longevity may be impaired by the existing long-term overdraft in the area east of Stockton. Besides water supply opportunity, this site provides means to supplement South Delta inflow which has been identified as insufficient to meet SWRCB requirements at Vernalis.

References:

Department of Water Resources, 1990, *Historical Ground Water Levels in San Joaquin County*, State of California.
Stockton East Water District, 1978, *Water Action Program.*
Bureau of Reclamation, 1980, *Stanislaus River Basin Alternatives and Water Allocation Special Report*, Department of the Interior.
Bureau of Reclamation, 1972, *An Appraisal of Oakdale and South San Joaquin Irrigation Districts Stanislaus River Water Rights*, Department of the Interior.

Name of Component: James Irrigation District-Raisin City Water District, Mid-Valley Canal, Reaches 1-3

Location: Central Fresno County

Groundwater Site Map Location: 11

Type of Operation: Conjunctive use. Develop a surface water distribution to serve areas presently relying on groundwater in the vicinity of Reaches 1, 2, and 3 of the proposed Mid-Valley Canal during wet years. Water delivered to this region would fill a pumping hole above the E-clay from which groundwater could be pumped in dry years to reduce dependence on surface supplies for James and Tranquillity IDs and Westlands Water District. Deliveries could be made through utilization of off-season capacity; however, traditional peak month service was assumed which would require additional Delta-Mendota Canal capacity.

Gross Storage Capacity/Depth Range: Gross capacity of the area is about 9.2 million acre-feet of capacity between depths of 50 to 300 feet.

Active Storage Capacity: Storage would be limited to six-year exchangeable supply to districts listed above. The exchangeable supply is estimated to be about 134,000 acre-feet per year with a six-year total of about 800,000 acre-feet.

Operation to Exceed Historical Maximum Depth: Yes. The effect is to be determined. Depending on the siting of the well field for service to Westlands, localized impacts may occur.

Infrastructure Required:

Conveyance Facility: About 440 cfs of capacity in the proposed 1,500 cfs increase in the Delta-Mendota Canal, plus an equivalent capacity extension through the first three reaches of the planned 1,500 cfs Mid-Valley Canal main branch.

Recharge/Distribution System: A distribution system to serve 440 cfs in lieu of groundwater pumping would serve about 44,000 acres.

Extraction: The exchangeable supply has an equivalent peak month demand of 610 cfs.

Long-Term Regional Conditions: Depressed groundwater levels in the Raisin City area indicate potential for existing long-term overdraft.

Cost: Major component of cost would be expanded Delta-Mendota Canal capacity, portions of which could be allocated to other projects. Costs would be reduced if the system is base-loaded and more fully utilized during non-peak months.

Capital ($M): $310
Annual ($M): $6.2
Unit Cost ($/acre-foot): $388

Component-Specific Environmental Evaluation: To be determined. Increased Delta exports in wet years; reduced export in dry years. Canal alignment through the valley floor may cross wetland areas.

Issues:

Legal and Institutional: Requires organizing independent groundwater pumpers and coordinated agreement with Mid-Valley Water District, James Irrigation District, Raisin City Water District, and Westlands Water District.

Source Water Quality: Delta.

Groundwater Quality: Westerly sources of groundwater in Westlands WD are of poor quality for irrigation.

Site or Route Land Ownership and Use: To be determined. Multiple districts and private ownership.

Socioeconomic: Stabilization of groundwater prolongs economic viability of existing land use.

Preliminary Assessment Considerations: Principally dependent on transfer of storage with minor opportunity to utilize surplus Delta flows.

References:

Bureau of Reclamation, 1990, *San Joaquin Valley Conveyance Investigation*, Department of the Interior.

Bureau of Reclamation, 1978, *Mid Valley Canal, Groundwater Geology and Resources Feasibility Appendix*, Department of the Interior.

Bureau of Reclamation, 1980, *Mid Valley Canals, East Side Division, CVP, California--A Report*, Department of the Interior.

U.S. Geological Survey, 1992, *Simulation of Water-Table Response to Management Alternatives, Central Part of the Western San Joaquin Valley, California.*

Name of Component: Kern River Fan

Location: Kern County

Groundwater Site Map Location: 12

Type of Operation: Groundwater banking. Direct recharge of groundwater for a 25,000 acre site by spreading basins with recovery wells. Supplies are conveyed to and from the California Aqueduct.

Gross Storage Capacity/Depth Range: A rectangular area encompassing the project could hold approximately 1.2 million acre-feet between depths of about 50 and 250 feet.

Active Storage Capacity: Department of Water Resources studies indicate (Table D-2) approximately 930,000 acre-feet of net extraction were planned for the dry period.

Operation to Exceed Historical Maximum Depth: Yes. Within the banking area, drafts during extreme drought would lower projected water levels to about 80 feet below the no-project condition.

Infrastructure Required:

Conveyance Facility: Current participants plan development of a 1,000 cfs two-way canal to receive and return water from the California Aqueduct.
Recharge/Distribution System: About 3,000 acres of additional spreading capacity are planned which will recharge an additional 500 cfs.
Extraction: An additional 200 cfs of extraction is planned.

Long-Term Regional Conditions: Simulations indicate long-term decline of water levels regardless of project operations.

Cost: System is presently operational and basin deposits have raised localized groundwater levels in the area to within 50 feet of the ground surface. Costs for participation principally influenced by land values.

Capital ($M): $125
Annual ($M): $2.5
Unit Cost ($/acre-foot): $134

Component-Specific Environmental Evaluation: Possible wildlife impacts due to occasional spreading basin maintenance; diversion impacts in the Delta.

Issues:

Legal and Institutional: System is presently operational and highly utilized by existing participants. Participation may be limited.
Source Water Quality: Delta, Kern River, San Joaquin River.
Groundwater Quality: No significant problems.
Site or Route Land Ownership and Use: Many owners and participants.
Socioeconomic: None known.

Preliminary Assessment Considerations: Provides opportunity to store surplus winter flows as well as storage transfers.

References: Department of Water Resources, 1987, *Kern Fan Element, Kern Water Bank*, State of California.

Name of Component: Madera Ranch

Location: Western Madera County

Groundwater Site Map Location: 13

Type of Operation: Groundwater banking. Banking of water through artificial recharge via spreading basins. Put and take water would be through dead-level canal and pumping facilities connected to Mendota Pool. Take water would be exchanged with supplies delivered to the San Joaquin River Water Exchange Contractors from the Delta. This could be an integral part of the North Branch of the Mid-Valley Canal.

Gross Storage Capacity/Depth Range: A rectangular area encompassing the existing cone of depression could hold about 800,000 acre-feet between the depths of 20 and 100 feet.

Active Storage Capacity: About 350,000 acre-feet of storage is considered the operable volume within the existing cone of depression.

Operation to Exceed Historical Maximum Depth: No. Plans are to utilize existing dewatered space.

Infrastructure Required:

Conveyance Facility: A 400 cfs dead-level canal would be used to convey water between the site and Mendota Pool.
Recharge/Distribution System: Spreading basins would be constructed to recharge up to about 400 cfs.
Extraction: Recovery wells would be constructed to return 200 cfs to Mendota Pool.

Long-Term Regional Conditions: Water levels of dewatered areas may have stabilized but require evaluation regarding potential of existing long-term overdraft.

Cost: If combined with Mid-Valley Canal North Branch, the conveyance cost may be allocated to other uses, such as the North Branch of the Mid-Valley Canal service area.

Capital ($M): $60
Annual ($M): $1.2
Unit Cost ($/acre-foot): $171

Component-Specific Environmental Evaluation: To be determined.

Issues:

Legal and Institutional: No known impediments. Owner is in the process of forming a water district.
Source Water Quality: Delta and San Joaquin River.
Groundwater Quality: No known problems. To be determined.
Site or Route Land Ownership and Use: Single ownership.
Socioeconomic: No conversion of irrigated land.

Preliminary Assessment Considerations: Provides opportunity to store surplus winter water and to be expanded to serve the North Branch area of the planned Mid-Valley Canal.

References:

Bookman-Edmonston Engineering, Inc., 1996, correspondence to Bureau of Reclamation concerning Madera Ranch.

Name of Component: Mendota Pool/North Branch Mid-Valley Canal

Location: Madera, Merced, and Fresno Counties

Groundwater Site Map Location: 14

Type of Operation: Conjunctive use.

Component Description: Surface water delivery in lieu of groundwater pumpage in wet years would allow exchange pumping by Mendota Pool water rights settlement participants.

Gross Storage Capacity/Depth Range: Approximately 9.0 million acre-feet of gross storage available between groundwater depths of 50 and 200 feet.

Active Storage Capacity: The exchangeable supply was limited due to assumed limit of 500 cfs of canal capacity and 50,000 acre service area for banking deposits. The assumed six-year accumulation of storage (150,000 acre-feet/yr) is 900,000 acre-feet. The total gross storage would also include that of Madera Ranch. Spreading and extraction facilities of that project are not included in this component.

Operation to Exceed Historical Maximum Depth: Yes. With the exception of the Madera Ranch area, the basin/area of pumping for exchange of surface supply has not been as extensively utilized as a supplemental supply. Deposits would be made to adjoining areas which would lessen the underflow from the present surface water areas to the pumping hole to the east of the San Joaquin River.

Infrastructure Required:

Conveyance Facility: Requires approximately 500 cfs of the enlargement of the Delta-Mendota Canal plus a 500 cfs new northern branch of the proposed Mid-Valley Canal. If the Madera Ranch site were also served, costs of these facilities could be reallocated. Conveyance from extractions in North Branch areas to exchanges west of Fresno Slough may be necessary to avoid water quality problems.

Recharge/Distribution System: 500 cfs of distribution system capacity to deliver surface water in lieu of groundwater pumping. This size was limited to provide comparable capacity to the planned Mid-Valley Canal North Branch.

Extraction: The 500 cfs size was selected to match the import conveyance capability.

Long-Term Regional Conditions: Dewatered areas may have stabilized but require analysis to determine if long-term overdrafts have abated.

Cost: Costs could be partially allocated to the proposed Madera Ranch site. Additionally, the system could be resized to allow more of a base-load use rather than a peaking requirement. Conveyance from the North Branch service area to west of Fresno Slough has not been included in the costs.

Capital ($M): $321
Annual ($M): $6.4
Unit Cost ($/acre-foot): $357

Component-Specific Environmental Evaluation: To be determined.

Issues:

Legal and Institutional: Requires coordinated operation with adjacent water districts. Would likely require formation of appropriate water supply entity.

Source Water Quality: Delta is the source of supply.

Groundwater Quality: Groundwater quality in western areas may be an issue.

Site or Route Land Ownership and Use: Many landowners in area presently are not organized for both surface and groundwater irrigation.

Socioeconomic: Stabilized groundwater prolongs economic viability of region.

Preliminary Assessment Considerations: This project would principally rely on storage transfer to develop long-term water supply reliability.

References: Bureau of Reclamation, 1990, *San Joaquin Valley Conveyance Investigation*, Department of the Interior.
Bureau of Reclamation, 1978, *Mid Valley Canal, Groundwater Geology and Resources Feasibility Appendix*, Department of the Interior.
Bureau of Reclamation, 1980, *Mid Valley Canals, East Side Division, CVP, California--A Report*, Department of the Interior.

Name of Component: Mojave River Basin

Location: San Bernardino County

Conveyance Facility Map Location: 15

Type of Operation: Water banking.

Component Description: Utilize planned pipelines to deliver wet-year surplus supply for artificial recharge by spreading in Mojave River bed and retrieve dry-year SWP entitlement by exchange in the Delta. The local area will remain on groundwater. No additional extraction facilities would be required.

Gross Storage Capacity/Depth Range: 1.8 million acre-feet.

Active Storage Capacity: Use of storage would be limited to dry-period exchangeable SWP supply estimated to total about 200,000 acre-feet.

Operation to Exceed Historical Maximum Depth: No. The basin is heavily overdrafted and exchange of entitlement for banked water would not draft the base.

Infrastructure Required:

Conveyance Facility: 100 cfs
Recharge/Distribution System: 100 cfs
Extraction Facilities: 0

Long-Term Regional Conditions: Overdraft

Cost: Largely funded through various grants as part of groundwater remediation efforts in the region.

Capital ($M): $60
Annual ($M): $1.2
Unit Cost ($/acre-foot): $300

Component-Specific Environmental Evaluation: Some studies completed by the Mojave Water Agency.

Issues:

Legal and Institutional: Few. May compete with local delivery of surplus Delta flows.
Source Water Quality: Delta.
Groundwater Quality: This is the present source of supply to the basin which has proven to be acceptable.
Site or Route Land Ownership and Use: Mojave Water Agency.
Socioeconomic: None.

Preliminary Assessment Considerations: Provides opportunity to capture surplus Delta flows.

References: Mojave Water Agency, 1992, *Regional Water Management Plan: Issue Identification and Alternative Management Strategies.*

Name of Component: Semitropic Water Storage District

Location: Northern Kern County

Groundwater Site Map Location: 16

Type of Operation: Conjunctive use. Delivery of surface water to areas otherwise relying on groundwater supplies in wet years for both exchange of dry-year supply and well field return to the California Aqueduct.

Gross Storage Capacity/Depth Range: Approximately 4.1 million acre-feet of capacity exists in the District area between depths of about 170 to 470 feet.

Active Storage Capacity: An estimated 1 million acre-feet of banking storage can be developed under planned operation of the District which, under a repetition of a historical sequence of hydrology, would cause depths to range between 170 to 470 feet.

Operation to Exceed Historical Maximum Depth: Yes. Maximum operation depths would generally be a maximum of 40 feet deeper than the historical low.

Infrastructure Required:

Conveyance Facility: An additional 500 cfs conveyance from the California Aqueduct to the distribution system is planned for construction.

Recharge/Distribution System: About 230 cfs of capacity is required to serve the 23,000 acres planned for the banking project.

Extraction: Forty-two new wells are being constructed averaging about 3.5 cfs per well for about 150 cfs of exchange pumping and/or return to the aqueduct.

Long-Term Regional Conditions: Overdraft

Cost: Principal cost is developing surface water distribution systems.

Capital ($M): $130
Annual ($M): $2.6
Unit Cost ($/acre-foot): $130

Component-Specific Environmental Evaluation: Completed and mitigated by the District.

Issues:

Legal and Institutional: Approximately one-third of the capacity is allocated to existing participants. The District has ongoing negotiations with the other potential participants.

Source Water Quality: Delta water is the principal source supply.

Groundwater Quality: Some areas have less desirable groundwater quality which are not a source of supply.

Site or Route Land Ownership and Use: One principal district with which to negotiate.

Socioeconomic: Stabilizes groundwater and prolongs economic viability of existing uses.

Preliminary Assessment Considerations: This project would rely on storage transfer and banking of available wet-year supplies to improve the long-term and drought year reliability of the State's water resources system.

References:

1. Agreement Between the Metropolitan Water District of Southern California and Semitropic Water District and Its Improvement Districts for a Metropolitan-Semitropic Water Banking and Exchange Program, 1994.

2. Semitropic Water Storage District and Metropolitan Water District of Southern California, 1994, *Semitropic Groundwater Banking Project, Draft Environmental Impact Report, Environmental Planning and Technical Reports.*

Name of Component: Tuolumne-Merced Basin

Location: Located in Merced and Stanislaus Counties east of the San Joaquin River.

Groundwater Site Map Location: 17

Type of Operation: Conjunctive use. The region encompasses an area of about 375,000 acres. Existing surface water deliveries would be supplied by new groundwater production capacity in dry years, which would allow New Don Pedro Reservoir and New Exchequer Reservoir supplies to be released to the Tuolumne and Merced Rivers for instream and Delta uses. Recharge of the basin would occur in wet and normal years through stream seepage and overirrigation.

Gross Storage Capacity/Depth Range: Rough estimates of gross storage indicate about 3.05 million acre-feet for a depth range of 20 to 100 feet.

Active Storage Capacity: With the assumed cones of depression shaped to fit between the river basins, the active storage is estimated to be about 1,250,000 acre-feet. The exchangeable supply substantially exceeds this volume.

Operation to Exceed Historical Maximum Depth: Yes. This basin is not typically the principal source of supply. Historical maximum depths of about 70 feet would be exceeded by about 30 to 50 feet.

Infrastructure Required:

Conveyance Facility: None.
Recharge/Distribution System: None. Recharge of the system occurs naturally through applied water and stream percolation.
Extraction: Well fields would be constructed to serve areas of Modesto, Turlock, and Merced Irrigation Districts that rely on surface water supplies. This preliminary estimate is based on 50 percent of the surface water delivery from groundwater or 690 cfs.

Long-Term Regional Conditions: Stable water levels.

Cost:

Capital ($M): $40
Annual ($/M): $0.8
Unit Cost ($/acre-foot): $32

Component-Specific Environmental Evaluation: Loss of streamflow accretion from groundwater. Increased river flow in dry years.

Issues:

Legal and Institutional: The proposed operation exceeds existing practices. The initial draft from the basin may be an issue.
Source Water Quality: Merced and Tuolumne Rivers.
Groundwater Quality: No problems identified. To be determined.
Site or Route Land Ownership and Use: Existing agricultural area--multiple ownership.
Socioeconomic: Requires drafting a basin for an area that has historically utilized surface supplies. Although wells typically reach 250 feet, additional power costs and resetting of pumps may be required.

Preliminary Assessment Considerations: This would supply the San Joaquin River in dry years while impacting flows in wet and normal years due to loss of groundwater accretions to streams.

References:

U.S. Geological Survey, 1977, *Appraisal of Ground-water Conditions in Merced California and Vicinity*, Open file report 77-454.
Modesto Irrigation District - Bookman-Edmonston, and Gianelli, 1961, *Investigation of Supplemental Water Supplies for Modesto Irrigation District.*

Appendix C
Conveyance Attribute Matrices

Preliminary Working Draft
CALFED Bay-Delta Program
Storage and Conveyance Component Inventories

February 28, 1997

INTRODUCTION

Appendix C of the technical memorandum on *Storage and Conveyance Component Inventories* provides attribute matrices for each of the conveyance components identified in the Conveyance Components section of the technical memorandum. The attribute matrices contain information on the various attributes or characteristics of conveyance components, such as location, alignments, capacities, and other characteristics. This information was compiled to provide CALFED with a full range of potential conveyance components to be considered in the formulation of storage and conveyance alternatives developed in Phase II of the CALFED process.

Conveyance components and the information for the attribute matrices have been identified from past and current investigations. In nearly all instances, information for one or more of the attributes was not available in existing reports or studies. As the investigation of storage and conveyance alternatives continues, the attribute matrices for selected conveyance components will be investigated in greater detail.

The inclusion of any particular conveyance component does not represent an endorsement of that component by CALFED. The conveyance components identified in the technical memorandum on *Storage and Conveyance Component Inventories* and the information presented within this appendix represent conveyance projects which have been investigated or are being investigated and which have the potential to contribute to the objectives of the CALFED Program.

DESCRIPTION OF ATTRIBUTE MATRICES

The attribute headings for the conveyance component attribute matrices vary slightly from the attribute headings for the surface storage and groundwater storage matrices. Presented below are the attribute headings, with explanations, that are used for the conveyance components.

Name of Component - This heading identifies the name of the conveyance component.

Location - Identifies the county(ies) and starting and ending points of the conveyance facility.

Conveyance Map Location - Identifies the location number of the conveyance component used in Figure 3 of the technical memorandum on *Storage and Conveyance Components Inventories.*

Type of Conveyance Facility - Describes the type of conveyance facility represented by the component. The type of conveyance facility is categorized as new, expanded with regard to length or expanse of the distribution service area, or enlarged in terms of capacity. In some cases, existing conveyance components identified would be both expanded and enlarged.

Component Description - This heading contains descriptive information about the proposed operations or objectives of the component.

Storage/Conveyance Capacity(ies) - A general description of the operation of the conveyance facility is included here. Because nearly all of the conveyance facilities are linked to one or more storage facilities, a description of those links is included. The exceptions are the conveyance components which move water from the north of the Delta to the south of the Delta.

Cost - The cost of a component is separated into total estimated capital and annual costs. All capital costs are adjusted to 1996 dollars using the U.S. Bureau of Reclamation Construction Cost Trends updated to January of 1996. Annual O&M costs are estimated from prior studies and adjusted to 1996 dollars using the Consumer Price Index. If O&M costs were not specified in previous studies, it was assumed that the annual O&M costs are 2 percent of the total capital cost for pipelines, pumping plants, power plants, and canals. Where costs were not available, no efforts were made to generate cost estimates. Necessary new cost information will be generated in Phase II.

Component-Specific Environmental Evaluation - This provides a brief description of the environmental concerns associated with developing the proposed project. The description is limited to the specific project/component and does not include indirect environmental impacts/benefits for the Bay-Delta system. This type of general evaluation allows components to be fairly evaluated against one another. The impacts of a given component and all other related components will be undertaken in the formal impact analysis of the EIR/EIS.

Issues

Legal and Institutional - This attribute generally describes the existence of legal or institutional issues that could hinder the development of the project; for example, the existence of water rights claims and mandated flow requirements.

Source Water - This attribute generally indicates the water source of the proposed conveyance facility.

Site or Route Land Ownership and Use - The alignment of a conveyance facility is examined to determine if there is overlap with lands that can not be affected according to state and federal laws.

Socioeconomic - Socioeconomic impacts are qualified generally with regard to potential third-party impacts, changing land uses, or right-of-way considerations.

Preliminary Assessment Considerations - Conveyance components are assessed based on several general factors:

- The ability of the project to increase water supply opportunities. Due to the undetermined nature of future project operations which would affect a project's

ability to develop additional water supply opportunities, each component's ability to meet this assessment factor is defined as low, moderate, or high.

- The ability of the project to improve the operational flexibility of the State's water resources system. Once again, due to the undetermined nature of future project operations, each component's ability to meet this criterion is defined as low, moderate, or high.

The assessment based on the above factors is very preliminary, relying on the information compiled to date in the attribute matrices. The intent of the assessment is to quickly determine which components are clearly not compatible with CALFED objectives.

References - The source or sources of information used to complete the attribute matrix are listed.

CONVEYANCE COMPONENT ATTRIBUTE MATRICES

Provided on the following pages are attribute matrices for each of the 26 conveyance components identified in Table 3 of the technical memorandum on *Storage and Conveyance Inventories*. The attribute matrices for conveyance components are ordered alphabetically by the name of the component.

Name of Component: Berryessa Intertie

Location: Sacramento River

Conveyance Map Location: 1

Type of Conveyance Facility: New conveyance facility

Component Description: Surplus flows would be pumped from the Sacramento River, near the Sacramento Weir, and conveyed through a new canal to an enlarged Lake Berryessa.[1] This conveyance facility will be a two-way facility capable of moving water into and out of Lake Berryessa at a rate of 5,000 cfs. The facility will include a screened intake at the Sacramento River and a siphon crossing of the Yolo Bypass. A total of five pumping-generating facilities will be necessary. An alternative to the Berryessa Intertie would be to deliver water from an extension of the Tehama-Colusa Canal to Lake Berryessa.

Conveyance Capacity(ies): 5,000 to 12,000 cfs[2]

Constructibility: No significant constructibility issues have been identified.

Construction Time: Not determined.

Cost: Cost estimates have been indexed to January 1996 dollars from costs presented in 1978 for a conveyance facility with a capacity of 12,000 cfs.

Capital ($M): 1,642[2]
Annual ($M): 28.5[2]

Component-Specific Environmental Evaluation: Environmental impacts along the conveyance alignment have not been identified. Impacts to fisheries on the Sacramento River could be significant depending on the operation of these facilities.

Issues

Legal and Institutional: Not determined.

Water Source: Lower Sacramento River.

Site or Route Land Ownership and Use: Mix of public and private lands, including the Yolo Bypass.

Socioeconomic: Not determined.

Preliminary Assessment Considerations

Potential to Contribute to Increases in Water Supply Opportunities: High

Potential to Contribute to Operational Flexibility of the State's Water Resources System: High

This conveyance component is one of several alternatives for supplying surplus Sacramento River flows to an enlarged Lake Berryessa. This facility would substantially increase the ability to utilize off-stream storage at Lake Berryessa.

References: [1]CH2M Hill, undated, *Concepts for Reversing Environmental Losses and Meeting California's Water Needs in the 21st Century.*
[2]Anonymous, October 10, 1978 letter to R.A. Williams.

Name of Component: Chain-of-Lakes Storage and Conveyance Facility

Location: Sacramento-San Joaquin Delta from near Hood to Clifton Court Forebay.

Conveyance Map Location: 2

Type of Conveyance Facility: Off-stream storage and conveyance facility through and across Delta islands.

Component Description: A chain of up to eight contiguous lakes, created from flooded Delta islands, would function as an off-stream storage facility and isolated conveyance facility from the Sacramento River to Clifton Court Forebay. Islands would be connected via pumps and siphons constructed beneath Delta channels. Islands likely to be used for storage and/or conveyance includes all or portions of Tyler Island, Staten Island, Bouldin Island, Venice Island, Mandeville Island, Bacon Tract, Woodward Island, and Victoria Island.

Conveyance Capacity(ies): 15,000 cfs

Constructibility: Six siphons of 18-foot diameter and possibly pumping plants would be required to convey 15,000 cfs between islands. The siphons would be constructed and anchored in soft peat soils that would present a difficulty in supporting construction machinery and anchoring the siphons. There could potentially be up to eight Delta channel crossings. Both the soil type and the high water table in the Delta would create special problems during construction. A pumping plant/diversion with fish screens would be required at the intake from the Sacramento River; additional unscreened pumping plants would likely be required to achieve design flows through the siphons.

Assuming that the levees are of adequate height, the interior faces of the levees would require placement of additional material to armor them against wave wash and provide adequate strength. This would require an estimated 176 million cubic feet of earth and 28 million cubic feet of riprap for the islands identified above. The availability of adequate materials and the placement of that material in soft soils would be problematic.

Construction Time: Not determined.

Cost:

Capital ($M): Not determined.
Annual ($M): Not determined.

Component-Specific Environmental Evaluation: This component has the potential to significantly reduce the impacts of current diversion practices in the south Delta by moving the diversion to the lower Sacramento River. However, significant amounts of terrestrial habitat will be inundated as a result of flooding Delta islands for storage. Some habitat, particularly riparian habitat, could be created on the interior embankments of the levees used for storage. Significant environmental disruption could be expected during the construction of the siphons.

Issues

Legal and Institutional: Not determined.

Water Source: Lower Sacramento River.

Site or Route Land Ownership and Use: Approximately 34,000 acres of agricultural lands would have to be taken out of production and inundated for storage. A majority of the land is in private ownership.

Socioeconomic: Loss of agricultural production.

Preliminary Assessment Considerations

Potential to Contribute to Increases in Water Supply Opportunities: High

Potential to Contribute to Operational Flexibility of the State's Water Resources System: High

The Chain-of-Lakes facility could create a significant amount of storage in a location which offers a great amount of flexibility. This facility could reduce the impacts that are currently associated with south-Delta pumping practices. However, there could be significant third-party impacts associated with retiring 34,000 acres within a single geographic region.

References: Bookman-Edmonston Engineering, 1996.

Name of Component: Chico Landing Intertie

Location: Sacramento River to Tehama-Colusa Canal

Conveyance Map Location: 3

Type of Conveyance Facility: New conveyance facility

Component Description: This conveyance facility would convey water from the Sacramento River to the Tehama-Colusa Canal for storage in an off-stream storage reservoir located in the foothill region of the Coastal Range. This conveyance facility would allow a significant portion of the water for an off-stream storage site to be diverted within the leveed section of the Sacramento River. By doing so, the unleveed portion of the Sacramento River above Hamilton City would benefit from maximum peak flows for stream/channel maintenance.

Conveyance Capacity(ies): 5,000 cfs

Cost: The cost for this conveyance component has been estimated based on costs for similar facilities. More detailed cost estimates are necessary to determine the actual cost of this facility.

Capital ($M): 178
Annual ($M): 3.6 (2% of capital costs)

Component-Specific Environmental Evaluation: Potential environmental impacts associated with the canal alignment have not been determined. The potential impacts to fisheries on the Sacramento River resulting from pumping operations would be a key consideration in developing this project. It is anticipated, at this preliminary stage, that a diversion near Chico Landing would have fewer impacts than diversions at Red Bluff, the diversion point for the Tehama-Colusa Canal.

Issues

Legal and Institutional: Not determined.

Water Source: Upper Sacramento River.

Site or Route Land Ownership and Use: Not determined.

Socioeconomic: Not determined.

Preliminary Assessment Considerations

Potential to Contribute to Increases in Water Supply Opportunities: High

Potential to Contribute to Operational Flexibility of the State's Water Resources System: High

This conveyance facility has the potential to lessen the potential impacts of diverting Sacramento River surplus flows to off-stream storage facilities on the west side of the Sacramento Valley. Such a facility could improve the feasibility of developing new off-stream storage reservoirs on the west side of the Sacramento Valley.

References: Bookman-Edmonston Engineering, Inc., 1996.

Name of Component: Delta-Mendota Canal Enlargement

Location: Tracy Pumping Plant to Mendota Pool

Conveyance Map Location: 4

Type of Conveyance Facility: Enlargement of an existing conveyance facility

Component Description: The enlargement of the Delta-Mendota Canal would facilitate increased water deliveries to the proposed Mid-Valley Canal, North Branch and Main Branch. There have been several proposed alternatives for enlarging the Delta-Mendota Canal. The first would be to enlarge the canal from the O'Neill Forebay to the Mendota Canal, and the second would be to increase the capacity of the canal from the Delta to the Mendota Pool. The first alternative would rely on the use of the California Aqueduct to convey additional water supplies to O'Neill Forebay, whereas the second alternative would rely on the enlarged Delta-Mendota Canal to convey additional water. Additional capacity to move water to the Mendota Pool would enable increased deliveries to groundwater banking and conjunctive use areas in the San Joaquin Valley. Additional groundwater banking and conjunctive use programs in the San Joaquin Valley would increase the long-term reliability of the State's water supply and contribute to improving groundwater overdraft conditions in this area.

Conveyance Capacity(ies): 2,000 cfs

Cost: The estimated costs shown below are for enlargement of the Delta-Mendota Canal from the Delta to the Mendota Pool. Cost estimates have been indexed to January 1996 dollars based on 1985 costs presented by the Bureau of Reclamation in 1990.

Capital ($M): 360 (1985 costs - 273)
Annual ($M): 7.2 (2% of capital cost)

Component-Specific Environmental Evaluation: The impacts of the canal enlargement should be minimal, using existing rights of way, from O'Neill Forebay to Mendota Pool. Approximately 135 acres of agricultural lands would be lost. The impacts from increased diversions at the Tracy Pumping Plant would have to be addressed.

Issues

Legal and Institutional: Not determined.

Water Source: Sacramento-San Joaquin Delta.

Site or Route Land Ownership and Use: Uses existing rights of way throughout; from O'Neill Forebay to Mendota Pool, an additional 135 acres of agricultural lands will be acquired.

Socioeconomic: Loss of 135 acres of agricultural lands from O'Neill Forebay to Mendota Pool. A potential socioeconomic benefit would be a reduction in groundwater pumping costs which would result from recovering groundwater levels.

Preliminary Assessment Considerations

Potential to Contribute to Increases in Water Supply Opportunities: High

Potential to Contribute to Operational Flexibility of the State's Water Resources System: Moderate

The development of groundwater storage programs is an attractive option to CALFED because of the relative lack of environmental impacts when compared to surface storage facilities. Therefore, conveyance facilities which benefit groundwater storage programs are desirable options within the CALFED Program. While this conveyance

facility will facilitate groundwater storage programs, the impacts of increasing Delta diversions need to be evaluated.

References: Bureau of Reclamation, June 1990, *Report on the San Joaquin Valley Conveyance Investigation, California*, Department of the Interior.

Name of Component: East Side Canal

Location: Folsom South Canal to the Kern County Line

Conveyance Map Location: 5

Type of Conveyance Facility: New conveyance facility

Component Description: This conveyance facility would convey available flows from the American and Sacramento Rivers to the San Joaquin Valley. This conveyance facility would originate at Lake Natomas, where available flows would be diverted into the Folsom South Canal. Available flows from the Sacramento River would pumped into the Folsom South Canal through the proposed Hood-Clay connection. The East Side Canal would begin at the terminus of the authorized Folsom South Canal (Littlejohns Creek) and would convey water to the San Joaquin River, approximately 127 miles. The canal would terminate at the proposed Figrarden Reservoir on the San Joaquin River. The original plan formulation also included the proposed Montgomery Reservoir as a regulatory facility and facilities to introduce surplus Stanislaus River flows into the canal.

Conveyance Capacity(ies): 5,000 cfs

Cost: Cost estimates have been indexed to January 1996 dollars from 1960 costs presented by the Bureau of Reclamation in 1966.

Capital ($M): 800 (1960 cost -163)
Annual ($M): 16.0 (2% of capital cost)

Component-Specific Environmental Evaluation: Not determined.

Issues

Legal and Institutional: Not determined.

Water Source: Sacramento, American, and Stanislaus Rivers.

Site or Route Land Ownership and Use: Combination of public and private lands.

Socioeconomic: Not determined.

Preliminary Assessment Considerations

Potential to Contribute to Increases in Water Supply Opportunities: Moderate

Potential to Contribute to Operational Flexibility of the State's Water Resources System: Moderate

The East Side Canal could provide water to San Joaquin Valley areas that are currently experiencing groundwater overdraft conditions. This facility has been suggested as an alternative to the Mid-Valley Canal proposal. Both projects could provide water for use in conjunctive use and groundwater banking programs.

References: [1] Bureau of Reclamation, June 1966, *East Side Division, Initial Phase*, Department of the Interior.
[2] Bureau of Reclamation, June 1990, *Report on the San Joaquin Valley Conveyance Investigation, California*, Department of the Interior.

Name of Component: East Side Canal Extension

Location: San Joaquin River to Kern River

Conveyance Map Location: 6

Type of Conveyance Facility: New conveyance facility

Component Description: This conveyance facility would extend the East Side Canal described on the previous attribute matrix. This facility would originate at the San Joaquin River and convey water to the Kern River and potentially to the Cross Valley Canal. The canal would parallel the existing Friant-Kern Canal and would provide water to that canal through several intertie facilities. The canal would have a length of approximately 150 miles. Development of this conveyance facility, in conjunction with the East Side Canal, could enable Sacramento River water to be delivered to the California Aqueduct via the Cross Valley Canal. Such a facility could reduce south Delta diversions and impacts associated with those operations.

Conveyance Capacity(ies): 5,000 cfs

Cost: Cost estimates have been indexed to January 1996 dollars from 1960 costs presented by the Bureau of Reclamation in 1966.

Capital ($M): 479 (1960 cost - 100.4)
Annual ($M): 9.6 (2% of capital cost)

Component-Specific Environmental Evaluation: Not determined.

Issues

Legal and Institutional: Not determined.

Water Source: Lower Sacramento River through Hood-Clay connection and tributaries to the San Joaquin River.

Site or Route Land Ownership and Use: Not determined, although the proposed route would pass through several populated areas along the Sierra foothills.

Socioeconomic: Not determined.

Preliminary Assessment Considerations

Potential to Contribute to Increases in Water Supply Opportunities: Moderate

Potential to Contribute to Operational Flexibility of the State's Water Resources System: Moderate

As indicated for the East Side Canal, the extension of the East Side Canal could provide benefits to the objectives of CALFED by enabling surplus Sacramento River flows to be delivered to the San Joaquin Valley or the California Aqueduct via the Cross Valley Canal.

References: Bureau of Reclamation, June 1966, *East Side Division, Initial Phase*, Department of the Interior.

Name of Component: Folsom South Canal Enlargement/Extension

Location: Folsom South Canal at Hood-Clay Canal to proposed East Side Canal

Conveyance Map Location: 7

Type of Conveyance Facility: Enlargement and extension of conveyance facility

Component Description: The existing Folsom South Canal would be enlarged to a capacity of 7,000 cfs and extended to the proposed East Side Canal. The enlargement of this facility would enable available American River and Sacramento River flows (via Hood-Clay connection) to be conveyed to the San Joaquin Valley and the Folsom South service area. The Folsom South service area is comprised of portions of Sacramento and San Joaquin Counties from the American River south to the Stanislaus River. Water delivered beyond the Folsom South service area would be in conjunction with the proposed East Side Canal.

Conveyance Capacity(ies): 5,500-7,000 cfs

Cost: The cost for this conveyance facility shown below does not include the cost for construction of distribution facilities. The cost reflects only construction of an enlarged and extended Folsom South Canal.

Capital ($M): 110 (1966 cost - 23.5)
Annual ($M): 2.2 (2% of capital cost)

Component-Specific Environmental Evaluation: Impacts associated with enlarging and extending the canal should be minimal, using the existing rights of way. Potential impacts associated with increased diversions from the American River would have to be addressed.

Issues

Legal and Institutional: A significant legal/institutional issue which would need to be resolved prior to development of this project is the in-stream flow requirements on the American River.

Water Source: American River and the Sacramento River if a Hood-Clay connection is developed.

Site or Route Land Ownership and Use: Using existing rights of way throughout.

Socioeconomic: No significant issues.

Preliminary Assessment Considerations

Potential to Contribute to Increases in Water Supply Opportunities: Moderate

Potential to Contribute to Operational Flexibility of the State's Water Resources System: Moderate

The Folsom South Canal would provide water to portions of Sacramento and San Joaquin Counties to improve local supply reliability. As part of the East Side Canal Project, this facility would enable water deliveries to the San Joaquin Valley and potentially the California Aqueduct, which would increase the overall flexibility of the State's water resources system.

References: Bureau of Reclamation, June 1966, *East Side Division, Initial Phase*, Department of the Interior.
Department of Water Resources, September 1980, *Water Action Plan for the Folsom South Service Area*, State of California.

Name of Component: Friant-Kern Canal Enlargement

Location: Friant-Kern Intertie (junction point south of Kings River) to White River

Conveyance Map Location: 7

Type of Conveyance Facility: Enlargement of conveyance facility

Component Description: The Mid-Valley, Main Branch, would connect to the Friant-Kern Canal, enabling additional water deliveries to the Friant-Kern Canal. Additional capacity in the Friant-Kern Canal would be required to accommodate the additional water deliveries. The combination of an enlarged Friant-Kern Canal and construction of the Main Branch of the Mid-Valley Canal would allow surplus Delta flows to be delivered to the Tulare Lake Basin. Such a project could alleviate current groundwater overdraft conditions in this area.

Conveyance Capacity(ies): 1,500 cfs

Cost: Cost estimates have been indexed to January 1996 dollars from 1985 costs presented by the Bureau of Reclamation in 1990.

Capital ($M): 162 (1985 cost - 123)
Annual ($M): 3.2 (2% of capital cost)

Component-Specific Environmental Evaluation: Enlargement of Friant-Kern Canal would not result in major long-term wildlife impacts because the construction activities would occur in existing rights of way. Approximately three acres of riparian vegetation would be impacted at crossings of local surface waters by the Friant-Kern Canal.

Issues

Legal and Institutional: Not determined.

Water Source: Delta (California Aqueduct or Delta-Mendota Canal to Mid-Valley Canal); varies in quality. Millerton Lake (source water for existing Friant-Kern Canal); good quality.

Site or Route Land Ownership and Use: Uses existing rights of way throughout.

Socioeconomic: Not determined.

Preliminary Assessment Considerations

Potential to Contribute to Increases in Water Supply Opportunities: Moderate

Potential to Contribute to Operational Flexibility of the State's Water Resources System: Moderate

The Friant-Kern Canal Enlargement, in conjunction with the Main Branch of the Mid-Valley Canal, could improve the water supply reliability of the southern San Joaquin Valley and Tulare Lake Basin. Improving the water supply reliability of this area and improving the groundwater overdraft conditions could potentially improve the reliability of the State's water resources system during drought conditions.

References: Bureau of Reclamation, June 1990, *San Joaquin Conveyance Investigation*, Department of the Interior.

Name of Component: Glenn County to Lake Berryessa Conveyance Facility

Location: Connects proposed Glenn County storage facilities to Lake Berryessa.

Conveyance Map Location: 9

Type of Conveyance Facility: New conveyance facility

Component Description: The Glenn County to Lake Berryessa is the second leg of a conveyance facility connecting Shasta Lake to Lake Berryessa. There are numerous potential off-stream storage facilities in Glenn County which could store excess flows from the Sacramento River or storage from Shasta Lake. The conveyance facility described here would convey water from potential Glenn County reservoirs to Lake Berryessa and optionally from Lake Berryessa across the Delta to the export facilities, via a tunnel crossing beneath the Delta. This facility would have a total capacity of 10,000 cfs and would also be able to provide water to the Tehama-Colusa Canal and the Glenn-Colusa Canal. Water stored in proposed off-stream reservoirs in Glenn County would be delivered to Lake Berryessa by tunnel from proposed Glenn County reservoirs.

Conveyance Capacity(ies): 10,000 cfs

Cost: Costs have not been determined for this component.

Capital ($M): Not determined
Annual ($M): Not determined

Component-Specific Environmental Evaluation: Impacts associated with construction and operation of the conveyance facility would likely be minimal. The partial reduction of south-Delta diversions, replaced with deliveries through a Delta tunnel, could substantially improve the condition associated with Delta diversion operations.

Issues

Legal and Institutional: Not determined.

Water Source: Upper Sacramento River.

Site or Route Land Ownership and Use: Not determined.

Socioeconomic: Not determined.

Preliminary Assessment Considerations

Potential to Contribute to Increases in Water Supply Opportunities: High

Potential to Contribute to Operational Flexibility of the State's Water Resources System: High

The cost-effectiveness of this project needs to be evaluated, however, before the component can be seriously considered.

References: CH2M Hill, undated, *Concepts for Reversing Environmental Losses and Meeting California's Water Needs in the 21st Century.*

Name of Component: Hood-Clay Canal

Location: Sacramento River at Hood--Freeport to Folsom South Canal

Conveyance Map Location: 10

Type of Conveyance Facility: New conveyance facility

Component Description: The Hood-Clay Canal would be 18.7 miles long and include 3 pumping plants. This facility will enable flows from the Sacramento River to be delivered to the Folsom South Canal. This facility would be developed as part of an extension of the Folsom South Canal to serve water to the Folsom South service area (American River to the Stanislaus River) or a part of the East Side Canal project to provide water to the San Joaquin Valley and perhaps the California Aqueduct.

Conveyance Capacity(ies): 5,000 cfs

Cost: Cost estimates have been indexed to January 1996 dollars from 1960 costs presented by the Bureau of Reclamation in 1966.

Capital ($M): 237 (1960 cost - 47.0)
Annual ($M): 4.7 (2% of capital cost)

Component-Specific Environmental Evaluation: The environmental impacts associated with this facility would likely arise from the diversion of Sacramento River flow at Hood. This plan formulation includes a screened diversion, but the effectiveness of such a facility in reducing entrainment impacts requires further evaluation.

Issues

Legal and Institutional: Not determined.

Water Source: Lower Sacramento River.

Site or Route Land Ownership and Use: Combination of public and private lands

Socioeconomic: Not determined.

Preliminary Assessment Considerations

Potential to Contribute to Increases in Water Supply Opportunities: Moderate

Potential to Contribute to Operational Flexibility of the State's Water Resources System: Moderate

This conveyance component would supply water to the Folsom South Canal and to the East Side Canal if developed. The feasibility of this project varies depending on the accompanying development of conveyance and storage facilities beyond the existing Folsom South Canal.

References: Bureau of Reclamation, June 1966, *East Side Division, Initial Phase*, Department of the Interior.

Name of Component: Improved Through-Delta Conveyance

Location: Sacramento-San Joaquin Delta

Conveyance Map Location: 11

Type of Conveyance Facility: Improvement of existing Delta channel capacities

Component Description: The basic concept of Improved Through-Delta Conveyance is to improve the ability to move water from the Sacramento River across the Delta to Clifton Court Forebay and the Tracy Pumping Plant in a manner that reduces the impacts to the Delta ecosystem. There are currently numerous alternative configurations being considered for improving the through-Delta conveyance. Central to all is increasing channel conveyance capacities. The alternative configurations range from those focused on improving channel conveyance capacities to those which include extensive alteration of existing channel configurations to increase conveyance capacities, reduce channel velocities, and create extensive areas of aquatic and terrestrial habitat.

The North Delta Program and the Interim South Delta Improvement Program combine as one of the alternatives that are being considered. This alternative would focus on improving water conveyance capacities in the north Delta by enlarging the Delta Cross Channel gates structure, levee setbacks on the North Fork Mokelumne River, levee setbacks on the main stem of the Mokelumne River on the western end of Bouldin Island, and, as an option, constructing a new intake at Hood utilizing channel improvements on Snodgrass Slough and levee setbacks on Glanville and McCormack Williamson Tracts. In the south Delta, improvements would include construction of a new intake structure at Clifton Court Forebay, channel dredging of Old River north of Clifton Court Forebay, construction of seasonal barriers at the head of Old River, construction of flow control structures on Old River, Middle River, and Grant Line Canal, and increased diversions into Clifton Court Forebay of up to 20,430 cfs on a monthly average basis.

Another alterative focuses on extensive habitat improvements and creation of low channel velocities. This alternative includes a new screened intake at Hood utilizing channel improvements on Snodgrass Slough, levee setbacks on Glanville Tract, and conversion of McCormack Williamson Tract to a floodway. Other improvements in the north Delta would include setback levees on New Hope Tract, conversion of Brack and Canal Ranch Tracts to wetlands, setback levees on Terminus Tract and Staten Island to increase flow capacities, and conversion of Bouldin Island into aquatic habitat through the removal of a portion of the levees along the Mokelumne and San Joaquin Rivers. In the south Delta, improvements would include increasing the capacity of Old River, while reducing velocities, with levee setbacks on Palm, Orwood, and Bryon Tracts and on Victoria Island, constructing a new intake at the northern end of Clifton Court Forebay, and constructing a interconnection with Clifton Court

Conveyance Capacity(ies): Capacities for the various alternatives varies.

Cost: Cost for the various Improved Through-Delta Conveyance alternatives are currently being developed. The estimated costs for several of the alternative configurations will be developed in Phase II of the CALFED Program.

Capital ($M): Not determined.
Annual ($M): Not determined.

Component-Specific Environmental Evaluation: The environmental impacts or benefits associated with any Improved Through-Delta Conveyance alternative will vary. The basic objective of all alternatives is to improve wildlife habitat and reduce fishery impacts associated with current operations. Each alternative will accomplish this objective to varying degrees.

Issues

Legal and Institutional: Not determined.

Water Source: Sacramento-San Joaquin Delta.

Site or Route Land Ownership and Use: Not determined.

Socioeconomic: Not determined.

Preliminary Assessment Considerations

Potential to Contribute to Increases in Water Supply Opportunities: High

Potential to Contribute to Operational Flexibility of the State's Water Resources System: High

The Improved Through-Delta Improvement alternatives could substantially increase the ability to move water across the Delta while reducing impacts to the Delta ecosystem. Each alternative will have to be reviewed to determine the extent of potential benefits to the State's water resources system.

References: Department of Water Resources, November 1990, *Draft Environmental Impact Report/Environmental Impact Statement - North Delta Program*, State of California.
Department of Water Resources, July 1996, *Draft Environmental Impact Report/Environmental Impact Statement (EIR/EIS)- Interim South Delta Program (ISDP)*, State of California.

Name of Component: Isolated Delta Conveyance Facility, Canal

Location: Sacramento River at Hood--Freeport to Clifton Court Forebay.

Conveyance Map Location: 12a

Type of Conveyance Facility: New conveyance facility

Component Description: The Isolated Delta Conveyance Facility would divert high quality water from the Sacramento River, in the vicinity of Hood, and transport it around the eastern and southern perimeter of the Delta to the State and Federal diversion facilities. The canal would be 43 miles in length and hydraulically isolated from the Delta's channels. Historically, similar facilities have been formulated with a capacity of nearly 22,000 cfs, with the capability of releasing water to Delta channel along its route. More recent formulations would avoid Delta channel releases and would have a capacity ranging from 5,000 to 15,000 cfs. Recent formulations also include options for multiple intakes from the Sacramento River to create greater flexibility to avoid fish entrainment.

Conveyance Capacity(ies): 5,000, 10,000, 15,000 cfs

Cost: The cost of an isolated conveyance facility for the capacities identified above have been estimated. Estimated costs have been developed for a facility with a capacity of 23,300 cfs by the DWR in 1992 and are the basis of the estimated costs escalated to January 1996 dollars shown below.

Capital ($M): 888 (1992 costs - 759)
Annual ($M): 76.2

Component-Specific Environmental Evaluation: Previous reports have identified the potential environmental benefits of an isolated conveyance facility. These include (1) eliminating cross-Delta flows that would interfere with migrating salmon and other fish, (2) providing net positive flows in all major Delta channels, (3) eliminating present SWP and CVP detriment to aquatic fish food organisms in Delta channels presently used as conveyance conduits, and (4) greatly reducing the loss of eggs, larvae, and young fish to export diversions. Along the alignment of the proposed facility, the occurrence of the following would have to addressed and potentially mitigated for: 3 archaeological sites, 7 historical sites, 6 sensitive wildlife species, and 3 sensitive plant species.

Issues

Legal and Institutional: Not determined.

Water Source: Sacramento River.

Site or Route Land Ownership and Use: Combination of public and private lands

Socioeconomic: Loss of agricultural production

Preliminary Assessment Considerations

Potential to Contribute to Increases in Water Supply Opportunities: High

Potential to Contribute to Operational Flexibility of the State's Water Resources System: High

An isolated Delta conveyance facility could increase the ability to move water across the Delta without interfering with the Delta's ecology. However, the impacts of removing the volume of water exported water from the Delta, through an isolated facility, would have to be addressed.

References: Department of Water Resources, Undated, Department of Water Resources' Position On The Peripheral Canal and Other SB 200 Facilities, State of California.
Department of Water Resources, September 1995, *Isolated Transfer Facility Cost Estimate*, State of California.

Name of Component: Isolated Conveyance Facility, Pipeline

Location: Sacramento River at Hood--Freeport to Clifton Court Forebay

Conveyance Map Location: 12b

Type of Conveyance Facility: New conveyance facility

Component Description: This isolated conveyance facility would convey 5,000 cfs to Clifton Court Forebay from an intake at the Sacramento River near Hood. The intake would include a vertical flatplate "V" fish screen with baffles, fish bypass with adjustable inclined weir, and low lift pumping plant. The pipeline would be a 41.5-mile, 18-foot diameter, buried pipeline. This component would primarily provide water quality benefits for south Delta exports and incrementally reduce the total diversion from the south Delta.

Conveyance Capacity(ies): 5,000 cfs

Cost: Cost estimates were determined by the DWR in 1996.

Capital ($M): 2,593 (1996 costs)
Annual ($M): 50.5 (2% of capital cost)

Component-Specific Environmental Evaluation: 3 archaeological sites, 7 historical sites, loss of crop during construction, 6 sensitive wildlife species, 3 sensitive plant species.

Issues

Legal and Institutional: Not determined.

Water Source: Sacramento River.

Site or Route Land Ownership and Use: Combination of public and private lands.

Socioeconomic: Loss of agricultural production during construction.

Preliminary Assessment Considerations

Potential to Contribute to Increases in Water Supply Opportunities: Moderate

Potential to Contribute to Operational Flexibility of the State's Water Resources System: High

An isolated Delta conveyance facility with a capacity of 5,000 cfs could alleviate a portion of the impacts associated with south Delta exports. The merits of this alternative for an isolated Delta conveyance facility would have to be compared with the benefits of an isolated canal facility.

References: Department of Water Resources, January 29, 1996, Draft Memorandum to Steve Yeager from Stein Buer, State of California.

Name of Component: Keswick-Cottonwood Tunnel

Location: Keswick Dam to proposed Cottonwood Creek Storage Facilities

Conveyance Map Location: 13

Type of Conveyance Facility: New conveyance facility

Component Description: This project would be developed in conjunction with the development of storage facilities in the Cottonwood Creek basin. The tunnel from Keswick Reservoir would convey available flows from the Sacramento River or surplus storage from Shasta Lake or Clair Engle Lake to off-stream storage facilities.

Conveyance Capacity(ies): 10,000 cfs

Cost: No costs have been developed for this component.

Capital ($M): Not determined.
Annual ($M): Not determined.

Component-Specific Environmental Evaluation: Not determined.

Issues

Legal and Institutional: Not determined.

Water Source: Keswick Reservoir, Sacramento River.

Site or Route Land Ownership and Use: Not determined.

Socioeconomic: Not determined.

Preliminary Assessment Considerations

Potential to Contribute to Increases in Water Supply Opportunities: Moderate

Potential to Contribute to Operational Flexibility of the State's Water Resources System: Moderate

References: None.

Name of Component: Mid-Valley Canal (Main Branch)

Location: Mendota Pool to White River

Conveyance Map Location: 14

Type of Conveyance Facility: New conveyance facility

Component Description: The Main Branch of the Mid-Valley Canal would convey water from the Mendota Pool down the center of the east side of the valley and terminate at White River. The Main Branch of the Mid-Valley Canal is one component of the Mid-Valley Canal Project. Additional water deliveries to the southern San Joaquin Valley and Tulare Lake Basin could be used to implement conjunctive use and groundwater banking programs. Such programs in these areas could alleviate groundwater overdraft conditions and increase the reliability of water supplies to the area. Additionally, improved groundwater conditions, through delivery of surplus Delta flows could increase the reliability of dry year supplies for the State by reducing surface water deliveries to this area which could then rely on improved groundwater supplies.

Conveyance Capacity(ies): 1,500 cfs

Cost: Cost estimates have been indexed to January 1996 dollars from 1985 costs presented by the Bureau of Reclamation in 1990.

Capital ($M): 418 (1985 costs - 317)
Annual ($M): 8.4 (2% of capital cost)

Component-Specific Environmental Evaluation: The alignment of the Main Branch of the Mid-Valley Canal would encumber the following conditions which would have to be addressed: the existence of several archaeological sites and the loss of 25 acres of grassland, 280 acres of riparian habitat, 240 acres of marshlands, 1,640 acres of agricultural lands, and 500 acres of irrigated pasture.

Issues

Legal and Institutional: Not determined.

Water Source: Sacramento-San Joaquin Delta.

Site or Route Land Ownership and Use: Combination of public and private lands. Private lands include crops, vineyards, orchards, and pasture.

Socioeconomic: Loss of 480 acres of row crops, 390 acres of grain crops, 780 acres of vineyards and orchards, and 500 acres of irrigated pasture.

Preliminary Assessment Considerations

Potential to Contribute to Increases in Water Supply Opportunities: High

Potential to Contribute to Operational Flexibility of the State's Water Resources System: Moderate

The development of this facility would enable the development of groundwater programs to alleviate the overdraft conditions in the San Joaquin Valley and Tulare Lake Basin, which have been characterized as one of the most pressing water management issues currently facing the State.

References: Bureau of Reclamation, June 1990, *San Joaquin Valley Conveyance Investigation*, Department of the Interior.

Name of Component: Mid-Valley Canal (North Branch)

Location: Mendota Pool to Chowchilla

Conveyance Map Location: 15

Type of Conveyance Facility: New conveyance facility

Component Description: The North Branch would divert water out of Mendota Pool to a terminus at the Chowchilla River. The North Branch of the Mid-Valley Canal is one component of the Mid-Valley Canal Project. Additional water deliveries to the eastern San Joaquin Valley could be used to implement conjunctive use and groundwater banking programs. Such programs in these areas could alleviate groundwater overdraft conditions and increase the reliability of water supplies to the area. Additionally, improved groundwater conditions, through delivery of surplus Delta flows, could increase the reliability of dry year supplies for the State by reducing surface water deliveries to this area, which could then rely on improved groundwater supplies. The introduction of additional water supplies to this region could also improve flows on the San Joaquin River.

Conveyance Capacity(ies): 500 cfs

Cost: Cost estimates have been indexed to January 1996 dollars from 1985 costs presented by the Bureau of Reclamation in 1990.

Capital ($M): 82 (1985 costs - 62)
Annual ($M): 1.6 (2% of capital cost)

Component-Specific Environmental Evaluation: Loss of 110 acres of grassland.

Issues

Legal and Institutional: Not determined.

Water Source: Sacramento-San Joaquin Delta.

Site or Route Land Ownership and Use: Combination of public and private lands. Private lands include crops, vineyards, orchards, and irrigated pasture.

Socioeconomic: Loss of 370 acres of row crops, 180 acres of grain crops, 110 acres of vineyards and orchards, and 25 acres of irrigated pasture.

Preliminary Assessment Considerations

Potential to Contribute to Increases in Water Supply Opportunities: High

Potential to Contribute to Operational Flexibility of the State's Water Resources System: Moderate

The development of this facility would enable the development of groundwater programs to alleviate the overdraft conditions in the San Joaquin Valley.

References: Bureau of Reclamation, June 1990, *San Joaquin Valley Conveyance Investigation*, Department of the Interior.

Name of Component: Mid-Valley Canal (Main Branch Intertie)

Location: Mendota Pool to Friant-Kern Intertie

Conveyance Map Location: 16

Type of Conveyance Facility: New conveyance facility

Component Description: The Main Branch Intertie alternative of the Mid-Valley Canal Project would connect the Mendota Pool to the Friant-Kern Canal. This facility would enable Delta water to be delivered to the Friant-Kern Canal for delivery to the Tulare Lake Basin. This development of this project would require the enlargement of the Friant-Kern Canal. Delta water delivered to this area could be used to improve groundwater conditions in the southern San Joaquin Valley and the Tulare Lake Basin, through the development of conjunctive use and groundwater banking programs.

Conveyance Capacity(ies): 1,500 cfs

Cost: Cost estimates have been indexed to January 1996 dollars from 1985 costs presented by the Bureau of Reclamation in 1990.

Capital ($M): 450 (1985 costs - 341)
Annual ($M): 9.0 (2% of capital cost)

Component-Specific Environmental Evaluation: Loss of 270 acres of riparian habitat, 240 acres of marshlands, 1,000 acres of agricultural lands, and 200 acres of irrigated pasture.

Issues

Legal and Institutional: Not determined.

Water Source: Sacramento-San Joaquin Delta.

Site or Route Land Ownership and Use: Combination of public and private lands. Private lands include crops, vineyards, orchards, and pasture.

Socioeconomic: Loss of 90 acres of row crops, 60 acres of grain crops, 850 acres of vineyards and orchards, and 200 acres of irrigated pasture.

Preliminary Assessment Considerations

Potential to Contribute to Increases in Water Supply Opportunities: High

Potential to Contribute to Operational Flexibility of the State's Water Resources System: Moderate

The development of this facility would enable the development of groundwater programs to alleviate the overdraft conditions in the San Joaquin Valley and Tulare Lake Basin, which have been characterized as one of the most pressing water management issues currently facing the State.

References: Bureau of Reclamation, June 1990, *San Joaquin Valley Conveyance Investigation*, Department of the Interior.

Name of Component: Oroville Intertie (Cross Valley Conduit)

Location: Lake Oroville to Sites Reservoir

Conveyance Map Location: 17

Type of Conveyance Facility: New conveyance facility

Component Description: This project would include multiple large-diameter pipelines between Lake Oroville and the Tehama-Colusa Canal to convey flood flows and surplus storage to proposed off-stream storage facilities on the west side of the Sacramento Valley. This facility would enable the banking of surplus water that would otherwise be unregulated. The proposed pipeline would incorporate siphon crossings of the Sacramento River and other waterways. No previous detailed evaluations of this project were located.

Conveyance Capacity(ies): 5,000 cfs

Cost: No costs have been developed for this component.

Capital ($M): Not determined.
Annual ($M): Not determined.

Component-Specific Environmental Evaluation:

Issues

Legal and Institutional: Not determined.

Water Source: Lake Oroville - Feather River.

Site or Route Land Ownership and Use: Not determined.

Socioeconomic: Not determined.

Preliminary Assessment Considerations

Potential to Contribute to Increases in Water Supply Opportunities: High

Potential to Contribute to Operational Flexibility of the State's Water Resources System: High

References: CH2M Hill, undated, *Concepts for Reversing Environmental Losses and Meeting California's Water Needs in the 21st Century.*

Name of Component: San Joaquin East-West Aqueduct

Location: Merced River to California Aqueduct and Delta-Mendota Canal

Conveyance Map Location: 18

Type of Conveyance Facility: New conveyance facility

Component Description: This project would convert approximately 9 miles of the existing Newman Wasteway to a water supply aqueduct by constructing dikes or checkgates on existing drop structures. The proposed conveyance facility would have a screened intake on the Merced River which would divert water through a series of low-lift pumping plants to the Delta-Mendota Canal or the California Aqueduct. This project could enable surplus supplies from the Stanislaus, Tuolumne, and Merced Rivers to be transferred to other users through the Delta-Mendota Canal or the California Aqueduct.

Conveyance Capacity(ies): Newman Wasteway capacity = 4,300 cfs

Cost: The costs for this project were estimated in 1996.

Capital ($M): 25 (1996 costs)
Annual ($M): 0.5 (2% of capital cost)

Component-Specific Environmental Evaluation: The principal environmental impacts would be on instream flows, fish, and potentially high groundwater adjacent to the lower end of the Newman Wasteway.

Issues

Legal and Institutional: Need to secure title to Newman Wasteway. A change in points of diversion would be required for post-1914 appropriative rights under jurisdiction of the State Water Resources Control Board.

Water Source: Merced River.

Site or Route Land Ownership and Use: Uses existing rights of way of Newman Wasteway.

Socioeconomic: Not determined.

Preliminary Assessment Considerations

Potential to Contribute to Increases in Water Supply Opportunities: Moderate

Potential to Contribute to Operational Flexibility of the State's Water Resources System: Moderate

The water made available by this project would be available primarily during normal and wetter conditions, when State supplies are generally adequate. However, if the additional water could be banked in the San Joaquin Valley or the Tulare Lake Basin, then this project would add a measure of increased reliability to the State's water resources system.

References: Bookman-Edmonston Engineering, Inc., January 1996, *Concept Paper on the San Joaquin East-West Aqueduct.*

Name of Component: Shasta-Clair Engle Tunnel

Location: Shasta Lake to Clair Engle Lake

Conveyance Map Location: 19

Type of Conveyance Facility: New conveyance facility

Component Description: This project would be a pumping-generating facility to transfer surplus storage in Shasta Lake to an enlarged Clair Engle Lake. The conveyance conduit would a tunnel connecting the two reservoirs. Surplus storage in Shasta Lake would be transferred to Clair Engle Lake utilizing off-peak energy. The transferred water would remain in Clair Engle Lake until additional storage is needed in Shasta Lake. Water would be transferred back to Shasta Lake during on-peak periods energy periods, thereby generating power to recover the cost of pumping.

Conveyance Capacity(ies): 10,000 cfs

Cost: No costs have been developed for this component.

Capital ($M): Not determined.
Annual ($M): Not determined.

Component-Specific Environmental Evaluation: No environmental evaluations have been performed for this project. A significant issue to be addressed would be the required enlargement of Clair Engle Lake.

Issues

Legal and Institutional: Not determined.

Water Source: Shasta Lake.

Site or Route Land Ownership and Use: Not determined.

Socioeconomic: Not determined.

Preliminary Assessment Considerations

Potential to Contribute to Increases in Water Supply Opportunities: High

Potential to Contribute to Operational Flexibility of the State's Water Resources System: High

This project would develop additional storage capacity at the top of the State's water resources system where the maximum amount of operational flexibility can be exercised. Linked storage between Shasta and Clair Engle Lakes could enable Shasta Lake to maintain a high reservoir elevation which would benefit water temperatures on the Sacramento River.

References: None

Name of Component: Sacramento Ship Channel Conveyance and Western Delta Crossing

Location: Head of Sacramento Ship Channel to Clifton Court Forebay along the western perimeter of the Delta.

Conveyance Site Map Location: 20

Type: New conveyance facility

Component Description: Sacramento River flows would be diverted into the Sacramento Ship Channel and conveyed to a new conveyance facility from the lower ship channel to a tunnel crossing the Delta from east of Collinsville to Antioch. From Antioch, a new conveyance facility would convey water to Clifton Court Forebay.

Two major features of this component are described below:

- The Sacramento Ship Channel. The ship channel would be isolated by locks at the lower end of the channel to prevent intrusion of poorer quality Delta water into the conveyance system. A screened diversion would be constructed at the head of the ship channel or at an alternate location which connects to the ship channel (e.g., Sacramento Bypass). As an alternative to isolating the ship channel, a new canal could be constructed which parallels the ship channel, eliminating the need for locks, or the ship channel could be permanently isolated, eliminating its use for ship traffic.

- The Delta Tunnel Crossing. A Delta tunnel crossing from the Montezuma Hills area, east of Collinsville, to Antioch would be constructed to convey water across the Delta. The crossing would require a single or multiple tunnel(s) with a minimum diameter of 30 feet and a length of approximately 4 miles. A 30-foot-diameter tunnel would have a maximum conveyance capacity of 5,000 cfs. For a total conveyance capacity of 10,000 cfs, two parallel tunnels would be required.

The isolation of the Sacramento Ship Channel will require a lock at the mouth of the channel. The conveyance facility leaving the ship channel would cross the lower end of the Yolo Bypass and would therefore need to be protected against flood waters. The construction of a tunnel(s) across the western end of the Delta is complicated by the presence of deep peaty-mud soils. The exact nature of the geology in the proposed area of the crossing has not been investigated.

Conveyance Capacity(ies): 5,000, 10,000, or 15,000 cfs

Cost: The costs of elements of this component have not been identified. The cost of tunneling beneath the Delta has been roughly estimated by US tunneling contractors at $5,000 to $6,000 per linear foot for a diameter of 32 feet. A single tunnel, 4 miles long, would cost an estimated $110 to $130 million. Such a tunnel could convey 5,000 cfs. This estimated cost includes only tunneling and lining the tunnel and no other associated facilities.

Capital ($M): Not determined.
Annual ($M): Not determined.

Component-Specific Environmental Evaluation: There would likely be no significant long-term environmental impacts associated with construction of the facilities. Impacts associated with operation of the facilities are not completely known at this time. The major concern would be associated with altering the volume of water entering the Delta. The operation of the diversion facility in the location of the Port of Sacramento would likely have fewer impacts than current diversions in the south Delta and potentially fewer impacts than diversions associated with other proposed Delta isolated conveyance facilities, due to its location further upstream of the Delta.

Issues

Legal and Institutional: Not determined.

Water Source: Sacramento River.

Site or Route Land Ownership and Use: Mix of public and private lands. Potentially significant right-of-way issues associated with a new conveyance facility constructed through the populated area of Antioch.

Socioeconomic: Not determined.

Preliminary Assessment Considerations

Potential to Contribute to Increases in Water Supply Opportunities: High

Potential to Contribute to Operational Flexibility of the State's Water Resources System: High

This component has the potential to significantly reduce impacts associated with current diversion practices in the south Delta. Additionally, the alignment of the proposed conveyance facilities along the western perimeter of the Delta would be less intrusive to the Delta ecosystem than other proposed Delta isolated conveyance facilities. With regard to potential environmental benefits and reduced impacts from current operations, this component is potentially highly compatible with CALFED objectives. The major drawback to this component would be the cost of construction, operation, and maintenance.

References: None.

Name of Component: Tehama-Colusa Canal Enlargement

Location: Red Bluff Diversion Dam to the terminus of the existing canal near Dunnigan in Yolo County.

Conveyance Map Location: 21

Type of Conveyance Facility: Enlarged conveyance facility

Component Description: Enlarge existing capacity of the Tehama-Colusa Canal to 5,000 cfs for its entire 113-mile length. Existing capacity ranges from 2,300 cfs at Red Bluff Diversion Dam to 1,700 cfs at the terminus. The additional capacity in the canal would be used primarily for diversions to new off-stream reservoirs located in the eastern foothills of the Coastal Range. Diversions for storage would be made during flood flows and other periods of surplus in the Sacramento River and to facilitate storage transfers from Shasta Lake to off-stream storage reservoirs. Several options for enlarging the canal are currently being evaluated. The first option would entail reconstructing the existing canal to enlarge the capacity. This option would require phased construction to avoid disruptions in canal deliveries. The second option is the construction of a parallel canal, which can be constructed with minimal disruption to deliveries. Either option would rely on the existing diversion facility at Red Bluff, which would be enlarged.

Conveyance Capacity(ies): Capacity of existing canal ranges from 1,700 cfs to 2,300 cfs. Expanded capacity of 5,000 cfs for the entire length of canal.

Cost: No costs have been developed for this component.

Capital ($M): Not determined.
Annual ($M): Not determined.

Component-Specific Environmental Evaluation: Impacts of constructing either option should be minimal. The existing right of way would be used. Potential impacts associated with increased diversions at Red Bluff would need to be addressed.

Issues

Legal and Institutional: Canal is owned by the federal government. Some existing capacity may need to be dedicated to Delta uses.

Water Source: Sacramento River.

Site or Route Land Ownership and Use: Uses existing rights of way throughout.

Socioeconomic: No significant issues have been identified.

Preliminary Assessment Considerations

Potential to Contribute to Increases in Water Supply Opportunities: High

Potential to Contribute to Operational Flexibility of the State's Water Resources System: High

The ability to convey water to proposed off-stream storage facilities is key to their success. This conveyance component would provide one option for facilitating diversions to such storage facilities.

References: Bookman-Edmonston Engineering, Inc., October 1994, *Concept Paper on Bay-Delta Estuary Supplemental Water from the Northern California Aqueduct.*

Name of Component: Tehama-Colusa Canal Extension

Location: From existing canal terminus near Dunnigan to Clifton Court Forebay. Alignment continues south from existing canal terminus passing west of Woodland and Davis in Yolo County and east of Dixon, Elmira, and Collinsville in Solano County. Optional extension would include a Delta tunnel crossing similar to the one proposed for the Ship Channel Conveyance Component.

Conveyance Map Location: 22

Type of Conveyance Facility: New conveyance facility

Component Description: The Tehama-Colusa Canal would be extended by approximately 95 miles. Extension of the canal would link upper Sacramento River diversions to proposed off-stream storage at Lake Berryessa, the North Bay Aqueduct, and optionally the SWP and CVP Delta pumping facilities and the Contra Costa Canal.

Conveyance Capacity(ies): 5,000 cfs

Cost: No costs have been determined for this component.

Capital ($M): Not determined
Annual ($M): Not determined

Component-Specific Environmental Evaluation: No environmental evaluations have been performed for this component.

Issues

Legal and Institutional: Portion of expanded capacity may be utilized to provide water to urban areas adjacent to the Delta.

Water Source: Sacramento River.

Site or Route Land Ownership and Use: Need to obtain right of way.

Socioeconomic: Not determined.

Preliminary Assessment Considerations

Potential to Contribute to Increases in Water Supply Opportunities: High

Potential to Contribute to Operational Flexibility of the State's Water Resources System: High

The extension of the Tehama-Colusa Canal to an enlarged Lake Berryessa could substantially increase the ability to store surplus flows of the Sacramento River. If the canal were extended to the SWP and CVP Delta export facilities, both projects, as well as other local projects, would realize improved water quality and the impacts currently associated with Delta export operations would be reduced.

References: Bookman-Edmonston Engineering, Inc., October 1994, *Concept Paper on Bay-Delta Estuary Supplemental Water from the Northern California Aqueduct.*

Name of Component: Upper Eastside Foothills Conveyance Facility

Location: Sacramento River (upstream of Feather River confluence) and Feather River (upstream of Sacramento River confluence) to the Folsom South Canal.

Conveyance Map Location: 23

Type of Conveyance Facility: New conveyance facility

Component Description: This new conveyance facility would be extended from the Sacramento River and the Feather River to the Folsom South Canal, which would then connect to the proposed East Side Canal. This project would facilitate the diversion of high quality water to the San Joaquin Valley. The diversions from the Sacramento and Feather Rivers would be screened to reduce the impacts to fisheries. No significant investigations have been performed for this facility.

Conveyance Capacity(ies): 7,000 cfs

Cost: No costs have been developed for this component.

Capital ($M): Not determined.
Annual ($M): Not determined.

Component-Specific Environmental Evaluation: No environmental evaluations have been performed for this component. A major issue to be addressed would be the potential impacts of diversion on the Sacramento and Feather Rivers.

Issues

Legal and Institutional: Not determined.

Water Source: Sacramento and Feather Rivers.

Site or Route Land Ownership and Use: Combination of public and private lands.

Socioeconomic: Not determined.

Preliminary Assessment Considerations

Potential to Contribute to Increases in Water Supply Opportunities: Moderate

Potential to Contribute to Operational Flexibility of the State's Water Resources System: Moderate

References: None.

Name of Component: Westside Sacramento Valley Conveyance, Alternative A

Location: Shasta Lake to proposed Sites or Glenn Reservoir

Conveyance Map Location: 24

Type of Conveyance Facility: New conveyance facility

Component Description: This new conveyance facility would connect Shasta Lake with proposed storage facilities in the Cottonwood Creek Basin and with the proposed Sites or Glenn Reservoir. The alignment of the facility would be along the Coastal Range. The objective of this project is to deliver surplus storage and flood flows from Shasta Lake to off-stream storage facilities for use during other periods, droughts, or summer releases. The terminal storage facility (Sites or Glenn Reservoir) would be linked to the Tehama-Colusa and Glenn-Colusa Canals and would be able to release water for the demands of these facilities in lieu of diversions from the Sacramento River. This facility is one of the options that have been suggested for providing surplus Sacramento River flows to off-stream storage reservoirs on the west side of the Sacramento Valley. This facility would divert directly from Shasta Lake, thereby reducing or completely eliminating the need to divert flows from the Sacramento River.

Conveyance Capacity(ies): 10,000 cfs

Cost: No costs have been developed for this alternative.

Capital ($M): Not determined.
Annual ($M): Not determined.

Component-Specific Environmental Evaluation: No environmental evaluations have been performed for this component.

Issues

Legal and Institutional: Not determined.

Water Source: Shasta Lake, Sacramento River.

Site or Route Land Ownership and Use: Not determined.

Socioeconomic: Not determined.

Preliminary Assessment Considerations

Potential to Contribute to Increases in Water Supply Opportunities: High

Potential to Contribute to Operational Flexibility of the State's Water Resources System: High

References: CH2M Hill, undated, *Concepts for Reversing Environmental Losses and Meeting California's Water Needs in the 21st Century.*

Name of Component: Westside Sacramento Valley Conveyance, Alternative B

Location: Shasta Lake to proposed Sites or Glenn Reservoir

Conveyance Map Location: 25

Type of Conveyance Facility: New conveyance facility

Component Description: This new conveyance facility would be similar to Alternative A of the Westside Sacramento Valley Conveyance, but the alignment of the facility would be in the Sacramento Valley, roughly parallel to the Sacramento River. This facility would not link Shasta Lake with the proposed Cottonwood Creek storage facilities, but could accept flows from lower Cottonwood Creek from a new diversion. The conveyance facility would be linked to the Tehama-Colusa Canal and the proposed Sites or Glenn Reservoir. As with Alternative A, this facility would convey Shasta Lake surplus storage to new off-stream storage reservoirs without requiring additional diversions from the Sacramento River.

Conveyance Capacity(ies): 10,000 cfs

Cost: No costs have been developed for this conveyance component.

Capital ($M): Not determined.
Annual ($M): Not determined.

Component-Specific Environmental Evaluation: No environmental evaluations have been performed for this component.

Issues

Legal and Institutional: Not determined.

Water Source: Shasta Lake, Sacramento River.

Site or Route Land Ownership and Use: Not determined.

Socioeconomic: Not determined.

Preliminary Assessment Considerations

Potential to Contribute to Increases in Water Supply Opportunities: High

Potential to Contribute to Operational Flexibility of the State's Water Resources System: High

References: CH2M Hill, undated, *Concepts for Reversing Environmental Losses and Meeting California's Water Needs in the 21st Century.*

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